June, 1957

THE CHEMIST

VOLUME XXXIV NUMBER 6

Presentation of Gold Medal to

Dr. Roy C. Newton, Hon. AIC

Left to right: John H. Nair, retiring AIC President; Dr. Newton; Dr. Lincoln T. Work, Chairman of the Committee on Medal Award, and Dr. Henry B. Hass, New AIC President.

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Deadlines for *The Chemist*

Copy for the August issue of The Chemist should be in our hands by July 10th or earlier, if possible. Advertising copy for August should be received not later than July 15th.

THE AMERICAN INSTITUTE OF CHEMISTS does not necessarily endorse any of the facts or opinions advanced in articles which appear in THE CHEMIST.

Announcement

We are happy to announce that an Advisory Board for THE CHEMIST has been approved by the National AIC Council, to consist of nine members. Eight members have been named, with the ninth to be selected from the Western Chapter.

Those now on the Board are: Dr. Ray P. Dinsmore, Lawrence H. Flett, Dr. Bernard Friedman, Richard L. Moore, Dr. Walter J. Murphy, Dr. W. George Parks, Dr. Malcolm Renfrew, and Dr. William J. Sparks.

New ideas and suggestions are already being considered to make THE CHEMIST (founded to be a repository of wholly professional literature) even more readable and helpful.

Within these pages are the papers presented at the First Professional Session of the 34th Annual AIC Meeting.

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TO COME IN JULY

Feature articles will be "The Chemist in Management," presented by Dr. Wayne E. Kuhn, F.A.I.C. of Texaco, at the 34th Annual Meeting, which considers the new kind of professional career that is opening up for chemists, and "The Place of the Chemist in the World," some pertinent comments by Dr. Milton Harris, F.A.I.C., who recently received the Honor Scroll of the Washington Chapter.

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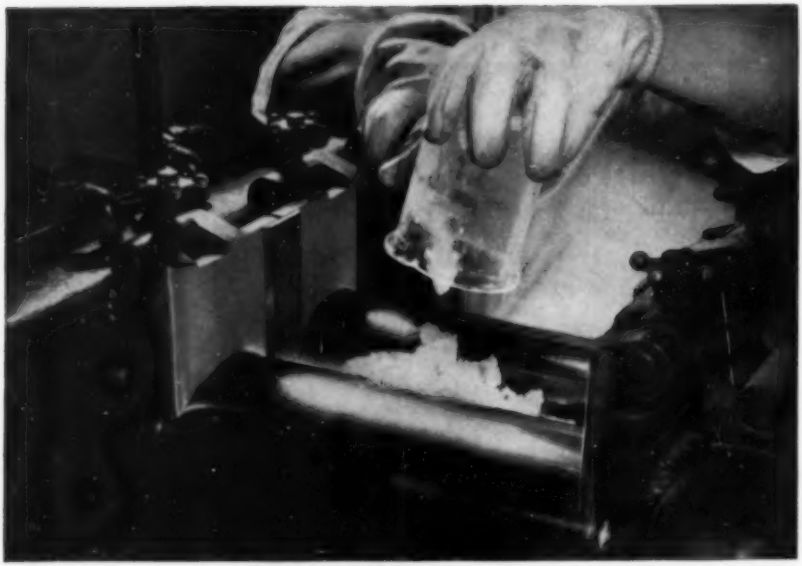

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EDITORIAL

The State of the Institute

John H. Nair

Retiring President, The American Institute of Chemists, Inc.

FROM many viewpoints, the past year has been one of the most active and successful in the recent history of the INSTITUTE. A banner increase in the number of Fellows and Members has resulted from the efforts of our active and energetic Membership Committee. The increase in annual dues was taken in its stride by practically all our members, resulting in an all-time high in the INSTITUTE's income. We have added a new local chapter, with the chartering in February of the Twin City Chapter. Efforts are in progress toward establishing additional local chapters in Florida, San Francisco and the Louisville-Cincinnati area which we hope will prove fruitful next year. This year we will award to some student medalist for the first time a prize of $100 for the best essay on "Chemistry or Chemical Engineering as a Profession."

The National Office is supporting the efforts of our Washington Chapter to obtain the passage of Senate Bill 1326 designed to establish a system for the classification and compensation of scientific and professional positions in the Federal Government as distinct from General Service positions. Our local chapters through their members have been urging the passage of a bill permitting self-employed chemists and engineers to set aside an untaxed portion of their incomes for building a pension fund.

Your president has visited personally this year every local chapter save the Niagara Chapter, where he is scheduled to speak early in June. The general level of activity is high in most of our chapters. A number of them have vigorous local programmes supporting projects for improving community welfare and participation by chemists in community activity.

Our Program Committee arranged for the 34th Annual meeting a noteworthy series of addresses by recognized authorities on a theme of major importance to us all. A number of companies manifested their interest in the subject by sending representatives from their personnel departments to attend these sessions.

It appears to me that the interest in and enthusiasm for the objectives and program of the INSTITUTE has mounted rapidly among our members this past year. Let us consolidate our gains, review our plans and move forward more strongly than ever toward achieving broader recognition in industry and the community at large for the chemist and chemical engineer as a professional man.

Special AIC Announcements

New Officers

The new president of the AIC is Dr. Henry B. Hass, president of the Sugar Research Foundation, 52 Wall Street, New York, N.Y. As president-elect during the past fiscal year, he succeeds John H. Nair as president.

Dr. Emil Ott, director, Central Chemical Research, and vice president, of Food Machinery & Chemical Corporation, P.O. Box 8, Princeton, N.J., was elected by the membership as AIC president-elect for 1957-58, to succeed Dr. Hass as president in 1958.

The following councilors-at-large, to serve for three years, were elected:

Dr. Johan A. Bjorksten, president, Bjorksten Laboratories, P.O. Box 1175, Madison 1, Wisconsin.

Dr. Charles H. Fisher, director, Southern Utilization Research Branch, U.S. Department of Agriculture, 1100 Robert E. Lee Blvd., New Orleans, La.

Karl M. Herstein, president, Herstein Laboratories, 44 New St., New York 4, N.Y.

New Honorary Members Chosen

At the AIC Luncheon held May 24 at the AIC Annual Meeting in Akron, Ohio, Dr. Ray P. Dinsmore, Hon. AIC, vice president of Goodyear Tire & Rubber Co., Akron, Ohio, and chairman of the Committee on Honorary Membership, announced that the following persons had been chosen to receive Honorary AIC Membership at ceremonies to be held sometime during the fiscal year 1957-1958:

Dr. Arnold O. Beckman, president Beckman Instruments, Inc., 2500 Fullerton Road, Fullerton, California.

Harold A. Levey, president, American Products Manufacturing Co., Oleander & Dublin Streets, New Orleans 18, La.

Bernard E. Schaar, president, Schaar & Co., 754 West Lexington St., Chicago 7, Illinois.

Dr. W. E. Hanford, vice president, M. W. Kellogg Co., 711 3rd Ave., New York, N.Y.

Revision of By-laws

At the meeting of the National Council on May 22, 1957, in Akron, Ohio, the following revision to the By-laws of the AIC was put into effect:

After Article XIV, add "Article XV—Charters to Local Chapters," to read: "Section 1. The Council is empowered to grant local Chapters, now existing or hereafter established, a Charter in a form approved by the Council and is also empowered to revoke any Charter for failure of the local Chapter to comply with the provision of the Constitution and/or the By-laws of the Institute."

Articles XV, XVI, XVII were then renumbered to read XVI, XVII, and XVIII, respectively.

Thank You!

To the Ohio Chapter and its chairman, H. M. Olson, gracious hosts for the Thirty-fourth Annual Meeting, May 22-24, in the "Rubber Capital of the World," Akron, Ohio.

To the Annual Meeting Committee whose excellent arrangements were so important to the success of our meeting.

To those who presided at the various professional sessions, luncheons, and the Gold Medal dinner.

To the authors who contributed the outstanding papers presented at the professional sessions, the luncheons, and the dinner.

To Swift & Company, which sponsored the reception to our Gold Medalist, Dr. Roy C. Newton.

To all who participated or worked to make this meeting successful.

To the many who could come to make and renew friendships in a professional atmosphere.

To New Chapter Officers

The new Chapter officers now being elected at the beginning of this fiscal year will find the "Manual of Chapter Operations" of much practical assistance. Copies are available, on request, from the Secretary, The American Institute of Chemists, 60 E. 42nd St., New York 17, N.Y.

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Employee Relations in the Laboratory

Dr. Roy C. Newton, Hon. AIC
Vice President, Swift & Company, Union Stock Yards, Chicago 9, Illinois.

(Presented when the author received the Gold Medal of THE AMERICAN INSTITUTE OF CHEMISTS at its 34th Annual Meeting, May 23, 1957, at Akron, Ohio.)

SCIENTISTS are often reticent to talk on subjects other than science and its application. Perhaps this is because scientific reputations are established exclusively on the basis of published results embracing new knowledge or new application. For one like myself who has long been out of the laboratory, it is good to have a sounding board in THE AMERICAN INSTITUTE OF CHEMISTS where things other than science receive first attention. There are several such organizations where scientists discuss problems of mutual interest other than science itself. One of these is the Industrial Research Institute, where problems of the administration of research are of chief concern. The American Institute of Chemists, however, is the only one where the welfare of scientists, their associations with each other and with their employer are specifically set forth as the main objectives.

After more than twenty-five years in an administrative capacity in such a group, I thought it would be interesting to set down some of my reactions. In doing this I have no thought that there will appear any new principles of human behavior, nor do I think that all of you will agree with my conclusions. . . .

Scientists working in industry have as their objective the integration of science with the operation of their company in such a way as to assist that company in the performance of a public service. From that service the company expects to extract a fair profit. This broad objective is the same whether these scientists are in research, development, or control. If science leads the way to a better product, a new product or a less costly product, it is certainly a public service.

Now, the jobs of an administrator of such a group of scientists are numerous indeed with all the selling of ideas, budgeting, consultation, recruitment, etc. It is worth while to note, however, that none of these functions are of any value except insofar as they are backed up by the productive work of the scientific personnel under his jurisdiction. I shall assume that this is so universally true and the minor qualifications so obvious that it needs no further discussion to conclude that the principal job of a scientific administrator is to provide that atmosphere which is most conducive to productivity.

If it is of such great importance, it then justifies all the careful analysis we can give it. This brings me to my subject, but I must confess that I

am not a psychologist. You would soon guess this fact at any rate!

What are the factors which make for productivity in an industrial laboratory? As a trial balance let us list them this way:

1. Well trained scientists with sharp intellects.
2. A good spirit of comradeship among the scientists and also between the scientists and other personnel in the company, at all levels.
3. Adequate modern equipment and reasonably pleasant building space and location.
4. Company and departmental policies which will leave no doubt in the mind of the employee (scientist in this case) that he will receive fair treatment and that his security and advancement are to be based solely on his accomplishments.
5. A salary scale that is as good or better than other companies.

I have put salary fifth in the list. This can be challenged. But I firmly believe that if a man's salary is fair it becomes less important to him than any of the other four points.

Let us consider what is behind these factors:

The indoctrination of a man begins with his interview prior to employment. A young man fresh out of college will remember his interview long after his employer has forgotten all about it. Hiring scientists today is not the same as it was during the depression years from 1930 to 1940.

Today, it is difficult to even set up interviews. In those depression years, applicants came to my office by the hundreds, and although we had no openings, I never failed to interview these men personally. They come up to me yet at scientific meetings and say, " I had an interview with you for employment in 1934, and you sent me to such and such a company."

I say to them, "I should have hired you. Do you want a job now?"

There are several factors of primary interest to a man who is looking for a job. These points should be kept in mind in starting an interview:

1. What kind of work will the man be doing? Does it fit with his particular training and interest?
2. What kind of facilities are available? What kind of people will he be working with?
3. What kind of business does the company have? Is it a successful company?
4. What are his chances for advancement? Can he be transferred to other work (sales, operating, etc.) within the company to broaden his opportunities?
5. What is the starting salary and salary policy?

Anyone who interviews applicants should have these facts down pat and give them in a straightforward manner.

The next step is to size up the man to see if he fits the needs of the job. Perhaps no two people would go about this in the same way, but I can give you my views.

You first will want to know about the man's training. Is he a bio-chemist, physical chemist, or what? Where did he graduate? Who was his major professor? If he has experience, where was it, and in what line?

If you know the universities and the professors, you have all you need

about his training from these questions. I learned a long time ago not to start asking these boys any technical questions. They were fresh from the classroom and so far ahead of me that I could not be sure whether they gave me the right answer! At any rate, if professors I know and respect graduate a man, it is good evidence that he has the basic training.

The things I really want to find out are (1) something about his character; (2) whether he has high standards of performance; (3) the sharpness of his intellect, and (4) his type of personality to determine whether he can be integrated with our staff.

So, I ask him any question that will get him to talk. Where were you born? What line of business is your father in? How many brothers and sisters do you have? What do you plan as your life work? I listen carefully for any handicaps that he may have overcome. I size up his enthusiasm and determine how quickly he can adjust his conversation to a change of subject. His degree of polish should be judged according to his age and home background and experience. It is not his present status but his potential for development that is important. These things cannot be learned by a yes-or-no type of interview. The man must be induced to display his spirit. Furthermore, if you do hire him after this kind of interview, he will be proud of himself and that is the best place to start his development.

The first month a man is on the job is most important. Most of us fail as administrators to take advantage of this impressionable period. To start his development we should assign him to work which will bring him into intimate contact with the best, most successful, most enthusiastic man on our staff.

During this beginning period, we must be sure that the man who is supervising this young chemist's work is understanding and sincerely interested in his progress. A warm, friendly, informal man-to-man relationship which would encourage constructive correction, and frequent evaluation of progress would do much to reduce the shifting which now occurs too often in a young man's early years.

Over the years, he will be a better man if:

1. He knows exactly what is expected of him.
2. He has enough work assigned to feel a challenge to be busy.
3. He is advised in advance of every change that affects him or his status.
4. He feels free to discuss his salary and status as well as his chances for advancement with his immediate supervisor and with the director of laboratories.
5. He feels that his supervisors are sympathetic and will go out of their way to help him overcome any inconveniences he meets.
6. He is treated with the respect due to a professional man.
7. His accomplishments are appreciated and moderately but sincerely praised.
8. He is encouraged to be bold in his plans and made to feel that any

honest mistake or failure of one of these bold ideas will not mitigate against his chance for advancement.

9. He can exchange ideas with full confidence that in the end he will get credit for his work.
10. He knows that he does not have to beg for a salary increase.

These things can be said in many different ways, and each of us will fall short of the ideal.

There is another facet to this matter of getting the right man for the right job, and it can be most important of all. How should we handle cases of separation? There are two classes of separation—the man quits or is discharged. He may be discharged for many reasons. However, most often it is because he gives unsatisfactory performance.

If a man is incapable on one task, he should be tried at another and given special attention in a sincere attempt to make him useful. In the end, however, if he must be replaced, it is important to be absolutely fair with him. He should be given plenty of time and help in finding a new job. Remember that you as an administrator made a mistake also when you hired him, or in his job training. Remember that all other employees are watching your spirit of fair play. Remember, too, that he may be a customer of yours on his next job!

Suppose on the other hand he is one of your really good men and you dislike very much to see him leave. This is your chance to learn how to improve conditions in your laboratory. Encourage this man to tell you if anything is irritating the men. Above all, be sure to tell him that you have appreciated his work and that if he doesn't like it where he is going, to come back and talk it over. You will often get them back and when you do, they are yours for life.

I mentioned comradeship as the second major factor in productivity. I recall, when I started on my present job thirty-two years ago, I was assigned a laboratory next to a fine elderly man by the name of Paul Escher. We had many interesting discussions and I remember well his emphasis on what he called the "cross-fertilization of ideas." It was his thesis that an idea was seldom mature until it had been rolled back and forth between two or more people having interest and insight in the subject.

Scientists are people, and people are happy when working among others whom they like and respect. Happiness alone would justify the creation of a cordial atmosphere among creative workers, but the value of "cross-fertilization of ideas" is so important that it transcends other reasons for harmony and mutual respect among scientists.

Such harmony can be developed in a laboratory, but it must be consciously sought and encouraged. We expect our men to work, not because they are driven, but because they are so enthusiastically interested that they cannot resist it.

Perhaps the most productive work they do is when they drop into another section of the laboratories to "try out" the germ of an idea with another scientist. This should be encouraged. Men should never have a guilt complex that someone suspects them of loafing.

In creative work, it is the result that counts—not the accountability of time. The older heads know this too well, but you have new men coming into your laboratory every year. New supervisors and new directors are appointed. It is important that these men be trained so that the proper attitude prevails from one administrative generation to the next. In the urgency of today's rapid industrial pace, it is an attitude which can be lost and it is difficult to re-establish.

We have found the informal project conference useful in bringing about an exchange of ideas between men of different scientific disciplines and different divisions of our laboratories. Each man reports on the work he is doing on a project and everyone has opportunity to discuss it and make suggestions. The secret is to conduct the conference on a friendly basis so that private discussions will continue afterwards.

More formal conferences including the commercial and manufacturing departments of the business afford a starting point for these non-scientists to influence the direction of our research to fit the needs of our business better. Our division heads are in weekly or even daily contact with the commercial and manufacturing people. All this helps focus our research and development program, but perhaps its effect in bringing about more cordial relations and generating a happy relationship is even more important.

A successful researcher must live with his project day and night. He cannot do this if there is a background of jealousy or criticism. A man may need criticism at times, but it should be done only by his superior and in private. The criticism should be clearly defined, friendly and constructive. The man should be encouraged to explain his position and allowed to come out of the interview a bigger man than when he went in.

I listed adequate modern equipment as one of the things necessary for productivity in an industrial laboratory. Industrial application of science is a highly competitive business. How would you like to enter the Indianapolis Automobile Race with a 1915 Model T Ford? No one will deny that important new developments can still be made with improvised equipment, but think how much more could have been done with a reasonable amount of laboratory and pilot plant equipment, and with good instrumentation. A man should be able to feel proud of the facilities available to him.

Adequate space is not enough if it is in a dilapidated building in unpleasant

surroundings. This may relate to pride and prestige, or it may be a matter of actual physical convenience. At any rate, I am speaking of *productivity* and not of some ephemeral thing which would be nice for the men in the laboratory. Productivity is what the company is paying for when we hire men and provide facilities. It is the administrator's job to consider all factors which affect these results.

Let me turn now to departmental and company policies. Departmental policies are so important and so much closer to the worker that they often overshadow company policies. Let us look at a few of the things which we as workers think are important, or if we are in an administrative capacity, let us think back to what we once thought.

First, we want recognition. Does the supervisor claim credit for ideas and accomplishments of his team? Does the boss want his name on every publication and patent issued from his department or division? If he does, someone will eventually be unhappy, and unhappiness takes a man's mind off his work. This is not an imaginary fault. Who among us in administrative work can honestly say that we have not been given credit at times for the work of one of our associates? It is a point which the administrator must consciously guard against.

Other factors are permission to publish the results of good research and encouragement to take part in activities of scientific societies. These and many more affect the prestige of a man, and prestige is a part of self-confidence. Who can do creative work without self-confidence?

While we are discussing these things under the heading of departmental policies, they might equally be considered under the subject of "Building Men." You cannot build men unless they are proud of their boss, their company, and their job, as well as being proud of individual accomplishment.

It has been my experience that men develop when their seniors place confidence in them. We often say a man grows because of experience or because he has had responsibility placed on him. It is my belief that he grows mostly because his superior had enough confidence in him to place the

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responsibility on him and let him get the experience. It was the prestige and ego which built the man. The experience was incidental.

These are the kinds of things which are within the scope of departmental policy so important to the creative productivity of a group of scientists.

In conclusion, let us look at company policy as the broad framework in which we hope to attain productivity in an industrial laboratory.

Our company president in a speech a few years ago summed up company-employee relationship. His statement of company policy was so clearly put that I quote it:

> Hire them young, select them carefully, teach them well, compensate them fairly, provide opportunities for advancement, assist them in sickness and adversity, and provide a pension for their old age.

Roy C. Newton

Dr. H. E. Robinson, F.A.I.C.

Director of Laboratories, Swift & Company, Union Stock Yards, Chicago 9, Illinois.

(Presented when Dr. Newton received the Gold Medal of THE AMERICAN INSTITUTE OF CHEMISTS, May 23, 1957, at Akron, Ohio.)

DR. Roy C. Newton was born in El Reno, Oklahoma, where his parents were pioneer settlers. In that new and rapidly changing community, farming and stockraising were important industries. This environment in Dr. Newton's formative years has strongly influenced his interests and activities in chemistry and foods.

His studies at Oklahoma A & M College were interrupted by World War I in which he served overseas with valor. Returning to school at Stillwater, he received the B.S. degree in chemical engineering in 1921. He continued his studies at the University of Chicago, receiving the doctorate in chemistry in 1924. Meantime, he taught for a year at Purdue University.

Dr. Newton joined Swift & Company's research staff in 1925. His advances were rapid. In 1930 he was made assistant chief chemist; in 1932, he was chief chemist; in 1941 he became the company's vice president in charge of research.

His personal research has added many valuable contributions to the food industries, particularly in the field of fats and oils. He has helped build a research staff that has added innumerable developments and demonstrated the tremendous value of research to the meat industry. Today, the research laboratories play an important part in the productive teamwork which has been built into the Swift organization.

For many years, Dr. Newton has felt that the pace of basic research

needed to be accelerated. The storehouses of fundamental scientific knowledge were being used up faster than they were being replenished. He did something about it. At his suggestion and under his direction, Swift & Company has encouraged basic scientific research in the fields of agriculture and human nutrition. Each year since 1941 fellowships and grants-in-aid have been made to universities and colleges. They have totaled more than a million and a half dollars.

Many of his colleagues feel that what Dr. Newton has done outside his own organization—for the chemical profession and science in general—equals or even surpasses his great achievements within his own company.

His unselfish service to chemical societies and scientific organizations has been outstanding. He is a past national president of the Institute of Food Technologists. He is active as a member of the American Chemical Society, having served as chairman of the Chicago Section, and was instrumental in establishing the biennial National Chemical Exposition. He has also been active as a leader in the Industrial Research Institute, American Oil Chemists' Society, George Washington Carver Foundation, the Nutrition Foundation, and the National Research Council. These are but some of his major contributions to science. He has most recently served in the forefront of organizing the Agricultural Research Institute.

On December 15, 1941, Oklahoma A & M added the name of Dr. Roy C. Newton to its Hall of Fame. That was the year Dr. Newton was appointed a vice president of Swift & Company in charge of research. It was the year also in which he became head of the modern scientific industrial research laboratory at Swift, the largest of its kind, in which are integrated several branches of science on agricultural and industrial problems.

The word "modern" in the sense of keeping up to date is an essential word in the Newton story. He has contributed much to modern living, modern science and modern industry, and has kept his own ideas up to the minute—so much so that he flies his own plane from his home in Three Rivers, Michigan, to his office in the Stock Yards at Chicago.

Dr. Newton has received many awards. The most recent are:

Nov. 10, 1947. Designated one of the "ten ablest chemists or chemical engineers" working in the United States in the field of industrial and engineering chemistry by a readers' poll conducted by the *Chemical Bulletin* of the American Chemical Society.

Jan. 2, 1948. Awarded Agricultural Alumni Certificate of Distinction by Purdue University.

Oct. 8, 1948. Awarded the Honor Scroll of the Chicago Chapter of THE AMERICAN INSTITUTE OF CHEMISTS.

July 12, 1949. Awarded the Nicholas Appert Award of the Institute of Food Technologists, for outstanding achievement of food technology.

May 6, 1952. Industrial Research Institute Medal "for outstanding accomplishment in leadership or management of industrial research."

June 1, 1952. Honorary degree of D.Sc. conferred by Purdue at 100th Commencement.

Feb. 17, 1956. Honorary membership, THE AMERICAN INSTITUTE OF CHEMISTS.

He is the holder of many patents, particularly relating to the stabilization of oils and fats. Probably the best known of this research work is his discovery and application of gum guaiac as an antioxidant in lard.

More about that farm life Dr. Newton commutes to by plane! He says that all he does is run the machinery on weekends as far as farm activity is concerned, and that Mrs. Newton is the on-the-spot manager. As a matter of record, her career is equally busy and colorful. Mrs. Newton, who was a farm girl from near Logan, Iowa, and an honor graduate of Iowa State College, had carved out her own career as a home economist and was on the Martha Logan staff at Swift & Company. After her marriage to Dr. Newton, her career expanded to housewife, mother, home economist, farm manager, breed association secretary, 4-H Club Leader, and a host of other activities among farm organizations.

Patents Issued to Roy C. Newton

1,701,084. William D. Richardson and R. C. Newton, Food Product. Feb. 5, 1929.
1,701,085. William D. Richardson and R. C. Newton, Salad Dressing, Feb. 1, 1929.
1,885,281. R. C. Newton, Method of Neutralizing Fatty Acids in Oils and Fats, Nov. 1, 1932.
1,890,585. R. C. Newton and William D. Richardson, Method of Stabilizing Fats and Oils, Dec. 13, 1932.
1,903,126. R. C. Newton and D. P. Grettie, Antioxidants for Fats and Oils, March 28, 1933.
1,911,222. Walter F. Bollens and R. C. Newton, Shortening Agents and Method of Producing the Same, May 30, 1933.
1,974,626. R. C. Newton, Oscar T. Bloom, and Levi S. Paddock, Treatment of Cracklings, Sept. 25, 1934.
2,024,131. R. C. Newton and F. L. DeBeukelaer, Preparation of Glue, Dec. 10, 1935.
2,031,069. W. D. Richardson, D. P. Grettie, and R. C. Newton, Stabilization of Oils and Fats. Feb. 18, 1936.
2,060,587. R. C. Newton and D. P. Grettie, Oil and Fat Treatment and Product, Nov. 10, 1936.
2,098,010. R. C. Newton, W. F. Bollens and L. C. Brown, Preparation of Emulsions, Nov. 2, 1937.
2,124,707. R. C. Newton and W. F. Bollens, Oil and Fat Deodorization, July 25, 1938.
2,155,733. R. C. Newton and F. L. DeBeukelaer, Gelatin, April 25, 1939.
2,168,626. R. C. Newton and F. L. DeBeukelaer, Glue Treatment, Aug. 8, 1939.
2,182,209. R. C. Newton and L. D. Mink, Egg Product, Dec. 5, 1939.
2,232,401. R. C. Newton and L. C. Brown, Treatment of Margarine, Feb. 18, 1941.
2,234,931. R. C. Newton and G. W. Phelps, Treatment of Supercooled Shortening, March 11, 1941.

Papers of Roy C. Newton

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Review of literature on meat for 1936. R. C. Newton, M. M. Piskur, J. M. Ramsbottom, H. E. Robinson, B. B. McLean. Food Res. **2**, 581-605 (1937).

Review of developments in food technology. R. C. Newton. Proc. Inst. Food Tech. 1942, 7-15.

American food supply. R. C. Newton. Proc. Inst. Food Tech., 1944, 162.

Newton describes research behind tender casing franks, bland lard. Natl. Prov. 112, No 4, 14 (1945).

Nutritional problems in the food industries. R. C. Newton and H. E. Robinson. Nutrition Revs. **4**, 193-5 (1946).

Progress Report on activities of the National Research Council's Committee on Veterinary Service for farm animals. R. C. Newton. J. Am. Vet. Med. Assoc. **109**, 268-72 (1946).

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Organization of research personnel. R. C. Newton Chem. Eng. News. **27**, 680-2 (1949).

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Salary administration among laboratory people. R. C. Newton. Trans. Am. Assoc. Cereal Chemists, **9**, 90-6 (1951).

The role of chemicals in foods. R. C. Newton, Canner, **114**, No. 23, 14, 23-4 (1952).

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Viewpoints on the problems of chemicals in foods; Viewpoint of a food manufacturer. Am. J. Public Health, **44**, 985-7 (1954).

The Chemical additive Amendment to the 1938 Federal Food, Drug, and Cosmetic Act. R. C. Newton. Food Drug Cosmetic Law J. **9**, 587 (1954).

Presentation of Gold Medal

THE Gold Medal of THE AMERICAN INSTITUTE OF CHEMISTS was presented to Dr. Roy C. Newton, vice president of Swift and Company, Chicago, Ill., at the Annual Gold Medal Dinner of the INSTITUTE, held at the Sheraton-Mayflower Hotel, Akron, Ohio, May 23, 1957.

Retiring president John H. Nair was toastmaster. Dr. H. E. Robinson, director of laboratories for Swift & Company, spoke on the medalist's life and achievements. The medal was presented by Dr. Lincoln T. Work, chairman of the Committee on Medal Award.

Dr. Newton's acceptance address was entitled, "Employee Relations in

the Laboratory." (See preceding pages.)

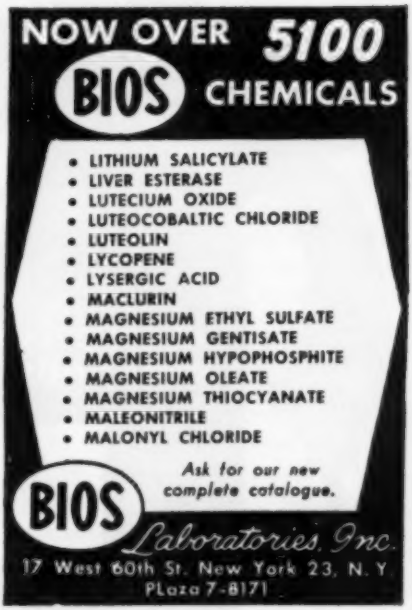
The citation to Dr. Newton reads:

Brilliant leader in food technology; wise champion of the consumer; brave soldier; loyal and patriotic citizen; tireless worker for the best interests of the profession; a man with unusual balance and professional competence — kind, sympathetic, and with impressive dignity.

Combined: Heyden Chemical Corporation and Newport Industries, Inc., into Heyden Newport Chemical Corporation, 342 Madison Ave., New York 17, N.Y. Simon Askin is president and Armin A. Schlesinger is chairman of the board of the new corporation. John P. Remensnyder, F.A.I.C., is vice chairman of the board.

New Laboratory Unit: Formed by Nopco Chemical Company of Harrison, N.J., to accelerate a program of evaluating new chemicals as vinyl stabilizer components. Dr. M. J. Kelley, F.A.I.C., director of the Industrial Specialties Labs., and Henry R. Thompson, chief chemist, operate the new laboratory.

Meetings: Of the Atomic Industrial Forum and the American Nuclear Society will be held Oct. 28-31, 1957, at the Coliseum, New York, N.Y. For information: Atomic Industrial Forum, 3 E. 54th St., New York 22, N.Y.



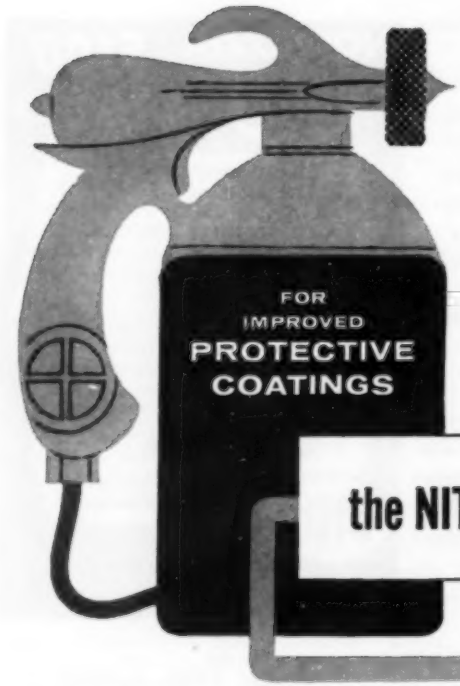
Will You Come

June 4, 1957. Niagara Chapter. Dinner meeting. Norton Hall, University of Buffalo. Speaker, John H. Nair, retiring AIC President, "The New Look in Foods."

June 6, 1957. New York Chapter. Dinner meeting. Hotel Commodore, New York, N.Y. Award of Honor Scroll to Dr. Clifford F. Rassweiler, F.A.I.C., vice chairman of the Board, Johns-Manville Corp., and president-elect of the Americal Chemical Society. For reservations ($8.00): F. A. DeAngelis, Foster D. Snell, Inc., 29 W. 15th St., New York 11, N.Y.

April 10-11, 1958. Thirty-fifth Annual Meeting. The American Institute of Chemists. Los Angeles, California. Host: The Western AIC Chapter.

May 14-15, 1959. Thirty-sixth Annual Meeting. The American Institute of Chemists, New York area. Host: The New York and New Jersey Chapters.



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Let's Get Together

Dr. J. William Zabor

Director of Research, Wyandotte Chemicals Corp., Wyandotte, Michigan

(Presented at the Keynote Luncheon, at the 34th Annual Meeting of The American Institute of Chemists, May 23, 1957, Akron, Ohio.)

IT is a popular pastime for writers to christen the age in which we are living. Each approaches the problem within the limitations of his personal experiences and prejudices. He comes up with a name which, in his biased opinion, describes the most significant activities of the era, or which best serves his immediate purpose. The disgruntled politician might call this the "age of bureaucracy" or "alphabet soup". We frequently hear references to the "cold war" but historians, looking back over the horrors of Fascism and Nazism, might integrate the past twenty-five years with the present and near future under the title of "The Trial of Democracy". The lawyer and the medical man might well refer to our period as "the birth of specialization". The clergyman, fondly or otherwise, might refer to this as "the age of Peale-ism or positive thinking". Even we who are engaged in technical pursuits are wont to use descriptive names, "the chemical age", "the plastics era", or 'the atomic age". For the purposes of this discussion, I prefer to look at this period as the "adolescence of science".

Except for the fields of mathematics and astronomy, we might facetiously say that the Renaissance period, insofar as natural science is concerned, might be classed as the early stages of pregnancy and the Reformation period as prenatal pains. It was not until the turn of the 17th century, when Bacon fathered the concept of experimental science, that one could be reasonably confident that a mis-carriage would not occur. The real birth of natural science might be said to have occurred only when the philosophers, followed by the scientists, recognized the relationship of cause and effect. Taking much from the teachings of Bacon and Locke, Hume was probably the first to expound on this relationship, when he said in 1739, "The same effect never arises but from the same cause". Since Hume was not entirely consistent in his pronouncements, it is difficult to ascertain how influential his writings may have been. It was approximately a century later that Mill more clearly stated that, "Every event has a cause and every cause has the same effect". Certainly little progress could be made in science until it was recognized that in an experiment, if you reproduce the conditions exactly you will reproduce the results. This is one of the cornerstones on which modern science has been built.

I would classify the next century-

and-a-half following Hume's treatise as the infancy of science and technology. Resembling an infant the scientific world found it difficult to learn more than one thing at a time and as a consequence progress, though significant, was slow in the modern sense.

Then came the severe growing pains of adolescence, which have become more severe as we pass through the stage of puberty. Believing in the relationship of cause and effect, we recognize that it is more than sheer fortuity that the start of this important era coincided with the advent of industrial research in the United States. Eastman Kodak Company was the first to establish an organized industrial research program in 1893; it was followed in 1895, by B. F. Goodrich; in 1896, by Electric Testing Laboratories; in 1900 by General Electric Company and U. S. Steel Corporation, and in 1902, by American Brass Company, E. I. duPont de Nemours and Company, and Westinghouse Electric Company. Bausch and Lomb Optical Company was added to the list in 1905 and American Telephone and Telegraph Company in 1907. This list of pioneers in research organization is comprised of some of the biggest, most successful and most respected companies in their particular fields. This, too, is more than fortuitous; the success of these companies has resulted in large part from their early beginning in organized research and their continued reliance on research through the intervening years for important advances in technology.

Dr. Raymond H. Ewell pointed out that our expenditure of $4,000,000,000 for research and development in 1955 was equivalent to the total spent in the United States from 1776 through 1933. Of the cumulative total of $43,000,000,000 spent from 1776 through 1955, the half-way point was reached in 1949. Research expenditures which were only .15% of our gross national product in 1929 grew to approximately 1.25% in 1955. In 1930 there was a total of 261,000 engineers and scientists employed. By 1956 this had risen to 950,000. In "A Study of the Scientific Manpower Problem of the United States", the B. F. Goodrich Company has estimated that 1,437,000 will be required in 1966. Their projection of current population and education trends indicates that the supply of engineers and scientists will be approximately 100,000 short of the anticipated requirement by 1966, compared with an estimated shortage of 6,300 in 1957. Estimates by others indicate the shortage in 1966 may be as high as 500,000. Thus, while research has grown to the proportions of an industry in itself, it is still in a period of rapid growth, suffering all of the pangs of adolescence.

How long will this glorious period of adolescence continue? By my definition it will end when the rate of growth of research, whether measured

in terms of manpower or expenditures or otherwise, decreases to the point where it is approximately equal to the rate of population growth—then, and not before, we shall reach the period of the "early adulthood of science."

Many conditions affect the longevity of our exciting era. The shortage of technical manpower could be the ultimate stumbling block. Statistics indicate that the desired rate of growth of research cannot be maintained unless we attract many more capable young men and women to the choice of technical educations and scientific careers. The government, college science professors, and enlightened industry are trying to do something about this. Each of you can and should help. It is prerequisite to our national security until such time as we develop more fundamental bases for permanently amiable international relations. Nevertheless, with due humility, in view of our own shortcomings in other fields if not in science, we must recognize that not everyone is mentally, physically or or psychologically suited to be a creative scientist and ultimately we will reach a limiting rate in the education of scientists which is proportional to the population. Thus inevitably, if other causes do not intervene, the growth era for research will terminate for want of personnel.

There have been expressions of concern that we are not developing new fundamental knowledge at a sufficient rate to provide a basis for continued expanding industrial application research. This situation must be improved lest it be the bottle-neck. Here again industry can and should take action by increasing the support of research in our universities as well as by accelerating basic research in its own laboratories.

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The rate at which our country can sociologically or economically assimilate new technological developments could well be the limiting factor which would cause the slow-down. Though we in industry and in scientific research should recognize this possibility and exert every effort toward rapid sociological development and continued economic balance, we must rely on sociologists, psychologists, economists, educators, clergymen, and others for more than just valuable assists.

These are but three of the many complex factors which influence the continuation or termination of research's golden era of adolescence and growth. A comprehensive consideration of any one of these could easily and profitably be the objective of

future program of the AMERICAN INSTITUTE OF CHEMISTS.

An even more important factor, which is more completely within our immediate control, deserves our concerted attention, not only because it is extremely important in its own right, but also because successful attempts at improvement will in part obviate the deleterious effects of some of the other factors. I refer to research efficiency.

The continued rapid growth of research activities is dependent on continuation of production of useful results which are at least commensurate with the expenditure of time, effort and money. The effects of technical manpower shortage may be alleviated to a degree by increasing the productivity of the available manpower. The long term economic ability of our country to assimilate a rapid succession of technological developments naturally is influenced by the cost of developing the technology as well as the economics of the results. Technical supremacy, which is so consequential in the international scene today is dependent on the quantity, quality, and economics of our results. In our free enterprise system we are in a very competitive environment which calls for ever-increasing efficiency in all of our activities, including research, if our companies are to prosper. In short, the improvement of reseach efficiency is one of the most pressing problems.

Some maintain that a research organization cannot train, assimilate and efficiently utilize an increase of staff in excess of 10 to 15 per cent per year. If this be true, most of us are members of inefficient departments, and research inefficiency, like awkwardness in youth, is one of the consequences of growing pains of our adolescence.

Those of you who have teenagers recognize the multiplicity of problems adolescence creates, both for the child and for the parents. Most of these problems cannot be solved independently; they must be faced cooperatively by the child and his parents. Similarly, in industry, particularly in industrial research, the solution of many of our most perplexing problems—the problems of adolescence—must be faced both by the scientists and engineers and by the administrative officers of our companies. The sincere concern of corporate executives is evident in the growing popularity of corporate and industry-sponsored "research on research itself". The concern of the chemist and chemical engineer is natural and is obvious by numerous expressions in the past. It is explicitly evidenced by the excellent program your committee has organized for this meeting of THE AMERICAN INSTITUTE OF CHEMISTS. Cooperation is the key; so—"Let's Get Together". Our purposes are common, our paths to solutions of the problems should be contiguous, because the benefits of solution will be mutual.

Thus far I have used the terms scientists, chemists, and engineers in a restrictive sense. I have talked exclusively about the professional employees who are directly engaged in scientific pursuits. This all-important group represents the heart of our organizations. Their performance regulates the performance of our companies. No research team or the results of its efforts is any better than the scientists who make up the team. Their productivity results in corporate growth; their failure as a group inevitably results in corporate failure. By all rights they should be at the top of our organization charts. The rest of the hierarchy in our industrial research organizations which is normally put at the top of the charts is designed simply to facilitate and expedite the creative and productive work of the scientists as individuals and as a team. Any attempt to increase research efficiency must be aimed at increasing the efficiency of these scientists as individuals and as a team.

On this basis I will discuss briefly some of the factors which influence efficiency and what management can and should do about them. In view of the premises mentioned, the individual should be able to infer at least some of his responsibilities in the mutually important problem.

Management's first task in the establishment of an efficient research organization is recruiting the most-creative scientists. This is one of the most difficult assignments but certainly one of the most important, inasmuch as there is no substitute for the creative researcher. Numerous recent investigations have been made into the nature of the creative process. Much progress has been made in these studies. Though none of these programs has as yet resulted in any simple infallible rules, they do offer increasingly valuable clews which aid us in selecting creative personnel, in persuading them to join our cause, and in stimulating their productivity. We shall follow with great interest the progress made in these fundamental inquiries with the expectation that they will contribute bountifully to our search for greater productivity in research.

Recruiting is a subject unto itself. Aside from its effect on salary structures and responsibilities and performance of present employees, it is outside the scope of your program. Suffice it to say that many of the factors which influence efficiency will

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aid in attracting desirable recruits who astutely recognize these influences on their productivity and future.

Having recruited our scientists, our next task is to automate them. The most obvious starting point is the provision of a modern and pleasant research laboratory with adequate facilities and utilities prerequisite to efficient research. Of equal apparent value in expediting the scientist's work is modern time-saving experimental and analytical equipment. Such apparatus can not only free the scientist's time and hands for more vital work but it can often increase his powers of observation and facilitate accomplishments impossible for his predecessors.

Judicious use of technicians for repetitive or routine work can also free the scientist to spend his energy on the more complex pursuits for which he has been trained. In most industries we have learned to double the output per scientist through this logical artifice, but it would seem reasonable to expect that we could multiply his efficiency many-fold more. In the same category we might place the provision of services such as dishwashing, glassblowing, instrument and apparatus construction, and repair and library services, including translations of foreign articles and general literature reviews. You can probably add other services which can not only be done more economically by less skilled personnel—and perhaps more efficiently as well—but which pay off a second time in added accomplishments of the unfettered scientist.

As our fund of knowledge has increased, so has the complexity of our research problems. Consequently most of our modern problems involve the application of more than one of the scientific disciplines and several fields of specialization within these disciplines. There is little doubt that an organic chemist, who has demonstrated his technical competence and creative ability in his chosen field, could master analytical chemistry, chemical engineering, or biochemistry if required to do so. From an efficiency standpoint, however, it is generally ludicrous to ask him to do so, when such skills are required in the solution of a research problem and when they are readily available in the organization. Thus we logically arrive at the modern concept of the team approach. The careful selection and use of such teams of specialists can go a long way toward increasing the efficiency of attainment of solutions to complex problems. Each team member need only have a broad and casual knowledge, but a deep appreciation, of the contributions that can be made by his teammates.

In research, as in other fields, a great deal can be learned from the results and experiences of others. Our knowledge is based on an accumulation of observations made by scientists every day and over the years. I must emphasize the need for good communications within the labora-

tory. An adequate system of communications can preclude needless repetition or duplication of effort, and hence can streamline the scientist's work and increase his efficiency.

A third function of management is to provide for the scientist the guidance required to make his work productive and the results useful. I refer to broad commercial and economic guidance rather than technical guidance. For example, what are the company's goals? What types of results of research could the company reasonably expect to handle financially and organizationally? Quite naturally the results of research will profoundly affect the corporation's goals and its future; and the scientist's vision of technical possibilities should be enlisted in the formation of detailed programs and goals. Nevertheless, the broad economic guideposts must come from the corporate officers. They will go a long way toward channeling the scientist's thoughts toward usable results and will preclude entering blind commercial alleys.

Research plays a vital role in the solution of the day-to-day technological problems of our companies—in the improvement of our processes and and products and their end uses. This service is a valuable assist to other members of the corporate team in the maintenance and expansion of the current line of business and the profits derived from it. In a growth company an even more important role of research is the development of new and diversified products. In either activity the most valuable research is that which anticipates the desires and needs of the customer even before he realizes them himself. The scientist has no corner on information which points toward these future needs. His real forte is in the development of means of satisfying such needs once they are anticipated. The ideas of what these needs will be originate from many diverse sources, so here again we must recognize the importance of communications—communications within the research department, communications with the sales department and other departments, and with top management, and communications directly with the outside world and particularly with the customers of the future.

I have stressed the desirability of giving the scientist broad commercial and economic guidance. Technical guidance was purposely omitted. Creative scientists must have freedom of thought and action and must not be regularly inhibited by the technical dictates of others. The communication of ideas and suggestions will often be helpful but, insofar as possible, the freedom of choice of the path to follow should be left to the scientist.

Hiring the most creative scientists, providing them with the best facilities and equipment, and giving them the broad commercial and economic guidance required, are all very im-

portant but alone they are not guarantees of efficiency and success. In addition, management must do everything in its power to make the scientist happy—but not contented! To be productive and efficient, a scientist must be happy and secure in his good fortune to be working for his employer; pleased with his past and present relationships with his associates, colleagues and superiors; protected from financial and other personal problems which might continually interrupt his thought processes; satisfied with the progress he has made professionally and otherwise. But to be a scientist, he must be discontent with the state of knowledge and with the products of technology, because it is his business to seek changes which are improvements over the present and past.

Financial remuneration is indeed of prime importance in any adequate program for human maintenance. It is the most concrete evidence of our valuation of the scientist. However, recognizing that our creative employees are somewhat higher than average in egocentricity and pride, we must take advantage of every opportunity to give recognition to the individuals and to their accomplishments both internally and in our public relations programs. Furthermore, in dealing with loyal and proud members of a productive team we must also not neglect to recognize publicly the value and accomplishments of the research department and its leaders.

Anything management can do to aid and accelerate the professional development of its employees will be very rewarding. Recognizing the creative man's insatiable appetite for increased technical knowledge, we can expect to reap increasing benefits from continuation and expansion of the educational programs and seminars most of us provide for our employees. Communication and association with fellow scientists from other organizations will aid in the professional development of the members of our staff. Regular attendance at professional society meetings can and should provide in part for such valuable contacts and associations.

The scientist is a purposeful being. There is nothing that gives him greater pleasure than to see the results of his work put to use. Thus the final thing that management must do, if it wishes to maintain an efficient and productive research department, is to make certain that it uses the products of research. Nothing will destroy efficiency and progress more rapidly than a management which places on the shelf indefinitely the valuable technology its team of scientists has succeeded in developing. The industrial scientist is not in search of knowledge for knowledge's sake alone. His incentive is to witness the visible changes

and improvements that result from his work. Shelving the successful results of one project makes practical use a more nebulous incentive for the next.

All progressive companies are giving increasing attention to the general welfare of all of their employees and to their problems. It has simply proved to be good business to do so. Furthermore, a well-run company gives more than "lip service" to the fact that all exempt salaried employees are part of management. If research scientists are an exception, it is because they are even a more vital part of management—more able to make unique contributions to the success of the enterprise. Thus your problems are your company's problems and your company's problems are yours. "Let's get together" on their solution. Accept your place on the management team with all of the responsibilities that place entails.

During this two-day session you will discuss some problems which would appear to be yours to bear. Remember that your employer is anxious to share in their solution. In other areas you will be "cussing" and discussing management and its ineptitude in handling some of the problems and its creation of others. Look in the mirror, fellow, because in part you are talking to and about yourself.

I have mentioned "communications" several times in describing the responsibilities of our employers. It should be equally stressed in describing the responsibilities of the scientist.

It is a human reaction that communications outward from ourselves are adequately maintained but that communications inward from others are woefully inadequate or even nonexistent. This reaction is very frequently based on a misconception and a misuse of the word. To communicate is to impart or convey or make known. It implies not only the sending of a message but the receiving as well. Too often we send messages which are not received, yet we feel we have communicated, and we become disgruntled because the reaction produced was not what we expected. As individuals we owe it to ourselves and as part of management we owe it to our companies to communicate our ideas and scientific findings not just to recite them to deaf ears. Communications both directions will soon make it evident that our problems are common, that they can most readily be solved by cooperation and the benefits will be mutual. *Let's Get Together* to increase the efficiency of research and thus to prolong this exciting era of progress and growth — the age of "adolescence of science."

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Personal Characteristics and Job Success

Dr. C. H. Elliott

Manager, Employee Relations, Socony Mobil Oil Company, Inc., East Chicago, Indiana.

(Presented at the Thirty-fourth Annual Meeting of The American Institute of Chemists, May 23, 1957, at Akron, Ohio.)

ARE you a success? Who says so? How about the man who works next to you, is he a success? How about your boss? Or the man who works for you? The president of the company? The floor sweeper?

Success in our society is the generally assumed goal of each of us. But what do we mean by success? Here are some examples of what I mean:

Case One. A chemist. He is believed by all his superiors to be "going places." He is considered as presently successful for his age (31) and a good prospect for promotion to higher levels in his company. But he considers himself stymied. He feels he has not moved fast enough. To him, the critical time in his life has arrived for him to move if ever he is going to succeed. He has given notice and will change jobs in a few days.

Viewpoints on success, then, differ.

Case Two. A college professor. Money income is often considered a criterion of success. Ten years ago this professor turned down a $25,000 per year job in industry. (Remember that in 1947, $25,000 was even more than a like amount today.) His grounds? "Why should I bat my brains out solving other people's problems so I can look forward to retiring at 65 and then be able to loaf, swim and play golf? I can do that now."

Criteria differ.

Case Three. Personal. This illustrates a point—again on viewpoints. Almost two years ago I left a university faculty position to take my present job. I have never been quite the same to my eight-year-old daughter. Daddy was a teacher; now he works in a factory. Teachers are important to school-children.

Are you a success? It all depends on who is looking and what they are looking for. Are you successful: In your own eyes? To your wife? To your children? To your neighbors? To your boss? To the "top brass" in your company? To your fellow workers? To those who may work for you? To the janitor?

Success is not an exact concept. It involves such things as money income, position in the organization, job performance, prestige and status, and self-satisfaction. These are the satisfactions for man's needs as a social creature. Translated into motivational terms they mean acceptance by the group—satisfying man's need to be gregarious; recognition for achievement and the feeling of accomplish-

ment and completion — satisfying man's need to be an individual, to have completed action and to compete.

To make the matter of success even less exact, these satisfactions and the needs they satisfy are not required in the same proportions in various individuals for each of them to consider themselves successful. The needs and the means of their satisfaction do not even remain constant within a single individual.

Your own goals change. Your hopes and aspirations are revised constantly on the basis of your experiences. How many "successful" research projects have your participated in? Did every one actually produce expected results? Was not the outcome often different than what was originally hoped for? Yet the project was a success as determined by aspirations as tempered by experience during the research. The same is true in each of our lives. Our goals and our means of attaining them vary from day to day or even from minute to minute depending on our experiences and our physical and mental state.

We can agree, in general, that the man who performs well on his job, who achieves many of his goals and who feels reasonably satisfied with himself is probably successful. It is in part his own self-regard and in part the way others regard him. Success is a matter of opinion. Degrees of it are not subject to exact measurement. The monastic pauper and the million-dollar roundtable insurance man can conceivably be equally successful.

This point should be readily apparent to industrial chemists. The chemist in industry has two primary roads to success. He may become a highly successful research chemist or he may become a highly successful administrator and manager—usually of chemical operations.

This brings us to personal characteristics. On the surface at least, the personal characteristics required of the research chemist may vary widely from those expected of the chemist turned manager. If you have done college recruiting, you have characterized interviewees as research material or managerial material. This may be even more pronounced in the field of engineering. We have all heard it said, "Joe isn't a very good process engineer but he's good supervisory material."

However, none of us would assume that good research and good engineering and good management are all mutually exclusive, or that an individual might not do two or all of them well at some time during his career. We would not assume, either, that a man might not change from being research oriented to be management oriented, or the reverse, given the proper set of circumstances.

The personnel specialist, especially if he is an industrial psychologist, is often considered the modern-day alchemist who knows how to put the characteristics together so as to turn

tne base metal to the gold of success. We have a hard time convincing the engineers and chemists with whom we work that we have not found a philosopher's stone either. We have even more difficulty convincing them that the relationships which may exist between these nebulous things known as personal characteristics and the will-o-the-wisp of success are quite different from the relationships which they have been trained to deal with.

We have done research at the refinery on these relationships. Recently we held an appraisal committee meeting as part of our management development activity. The committee was made up of our major department heads locally: The operating superintendent, the chief refinery engineer, the technical director (two trained in chemical engineering and one in mechanical engineering), and the employee relations manager. As the session broke up, we began casually discussing our personnel research into personal characteristics. I pointed out the half-dozen men in our managerial and professional group who most nearly conformed to our expected pattern of personal characteristics for successful job performance. The other three found it hard to believe that six such different persons had common characteristics. They did agree that the six were among our most successful — some were engineers, some managers, some chemists. Common characteristics do not mean identical persons. People do not come according to specifications like steel or gasoline or chemicals.

The relationships between personal characteristics and job success are difficult to explain in another way to men trained in the physical sciences and engineering. You are used to dealing in causal relationships. The personnel man almost never can deal in causal relationships. Ours are concomitant relationships. Things occur together with no cause and effect implied. Men interested in mechanical tinkering are successful engineers in our refinery more often than not. It does not follow that this interest causes success. It is more likely that whatever causes the interest also causes the success, but the interest and the success tend to occur together. Note that I said, "tend to occur together" and earlier I said, "are successful . . . more often than not." Because of this concomitant relationship, things do not inevitably occur together as when one causes the other — but if they occur together more than chance would indicate they should, then we have useful data. And we do not know the cause. Our engineers and chemists sometimes become impatient with us because we cannot be exact. However, this is the present state of the art.

And what personal characteristics are related to job success? Check lists and questionnaires will provide scores of items covering almost every personal trait anyone has ever tried to define. These inevitably cover char-

acter — those personal characteristics having moral aspects. We generally believe that a high moral character is important in job success today. At the same time, we are pretty sure that such characteristics as honesty are entirely relative to a given situation and vary with such environment factors as punishment, deterrents, potential gains, and past experience.

Check lists and questionnaires cover many other areas as well. For example: Age, education, health, attitudes, character, potential for development, conscientiousness, self-reliance, perseverance, decisiveness, impression on others, poise and self-control, mental power, mental vision, initiative, urge to accomplish, enthusiasm, tact and diplomacy, mental courage, interest in people, unselfishness, trustworthiness, adaptability, interest in community affairs.

Such listings as these cover a variety of characteristics. Some are unquestionably important in job success. But which? Such lists represent at best a compilation of ideas. More often they are a list of words which occur to the author of the list without any thought as to their real pertinence.

After doing research in this field, we begin to develop a healthy suspicion of off-hand opinions about the characteristics of people which are important in success. Some of the most extensive training activity in industry in recent years was in the field of human relations. Some of our findings supported by recent reports of other research indicate the approach if not the subject matter was erroneous. The standard approach in trying to teach people to be more successful by improving their handling of human relations situations is now suspect.

We also encountered other instances where characteristics we thought subjectively were important proved to have no relationship with job success, while other characteristics showed unexpected relationships.

I will point out here the specific characteristics of men in our refinery who are considered by their superiors to be most successful in their job performance as supervisors, managers, and professional chemists and engineers. These are the characteristics which we have actually measured by the best presently available measuring devices. There is no indication that the list is complete. These are our findings in our plant and our rationale to explain them:

1. The successful manager or professional is considerably above average in intelligence. He rates in the top 2 per cent so far as American males in general are concerned. We believe that the very nature of the industry we are engaged in makes a high level of adaptability and quickness in thinking essential. The additional fact that two-thirds of our managerial and professional group are degree men and another one-sixth have somewhere near enough college work for a degree probably serves to make this high level self-perpetuating. The competition in brain power is too keen for any but the top.

2. The successful manager, chemist or engineer in our plant has more interest in and more knowledge of everyday mechanical details than 70 percent of industrial supervisors in general. These are the kinds of details that surround all of us everyday now and when we were growing up. The individual who is sufficiently interested in them to pick up the details and the knacks seems to carry this capacity over into his everyday work and perceives details and relationships quicker and more effectively. This better perception enables him to conceive improvements and changes in equipment and procedures which are practical and down-to-earth. This characteristic is essentially in the realm of practical mechanics rather than abstract mechanical ability.

3. The successful individual on our managerial and professional role achieves some self-satisfaction out of using his language skills — reading and writing. He must enjoy doing these things to some extent today in order to keep up with the tremendous volume of technical literature which he faces almost daily. On the creative side he has to write the reports (and comply with the "red tape") that are an integral part of all business. His success to a great degree may depend on the facility with which he uses words and his willingness to use them extensively.

4. The successful manager or professional should not be a "do-gooder". This is the only negatively loaded characteristic which we found. Probably the very nature of business is incompatible with the outlook of the man who feels his primary responsibility in life is the welfare of others. This individual, incidentally, may not like people. He gains his satisfaction by manipulating them. Also, he is often heartily disliked by other peoule, since most of us prefer to control our own destinies and particularly abhor charity or "what is good for us."

Recently published results of research at Ohio State indicate that it is almost impossible for a supervisor to be oriented toward human relations with emphasis on social values and at the same time to be able to operate effectively in an organization structure or to initiate action and carry it through to successful conclusion.

5. The successful man in our plant is more straightforward and frank than the average man. He tends to face up to situations and people realistically. He may not be evasive enough to be a very successful diplomat but his brutal frankness seems to serve him well in our situation. (Whether or not this is true at higher levels or in other locations we do not know!)

6. The successful manager, engineer or chemist is generally predictable. His way of responding to most situations are well developed habit patterns not readily subject to change. This makes him easy to live with because everyone associated with him knows how he is likely to respond in a given situation and that he is not likely to vacillate each time the atmosphere changes.

7. The successful man on our managerial and professional role is emotionally steady. He is not readily given to emotional upheavals—at least his emotions are not apparent to those around him. Some men may have their emotions working for them. Others may be exerting control over their emotions at considerable cost to themselves. We have our share of ulcers, hypertensives, etc. Nevertheless our successful people make a show of keeping an even keel emotionally.

8. The successful professional or manager is not a worrier. He is free from this debilitating fear of things anticipated. Apparently he is content with his ability to handle situations as they arise and hence does not spend great quantities of energy being concerned about things which he can not control or which may never occur. This energy he can spend productively toward enhancing his job performance.

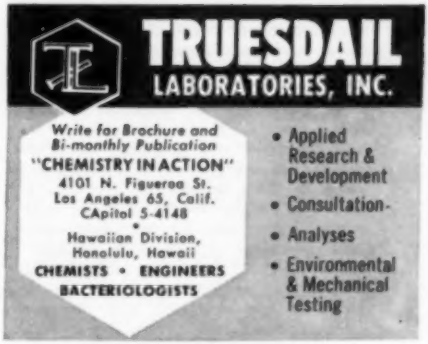
These are eight characteristics which our successful people have in varying degrees. Only ten per cent

of our most successful people possess all eight to the requisite degree but none of our less successful people do. Two-thirds of our most successful people possess four or more of these characteristics in some combination while only one-fifth of our less successful people fall in line on as many. Over 90 per cent of our most successful people have three or more of these characteristics while less than half of our less successful people have three or more of them.

They are not cause and effect. The relationship is not perfect and exact. People with common characteristics are not identical. Nevertheless, these personal characteristics are indisputably associated with job success in our situation.

There are, in addition, two factors important to job success which defy measurement. The first of these is personal motivation. How much an individual wants success and how hard he is willing to work to achieve it can overcome many shortcomings in personal characteristics. We have all seen creditable college work performed by students who are lacking in ability but who accomplish on sheer willingness to work. Appropriate personal characteristics with adequate motivation almost insures success.

The second immeasurable may sound like the antithesis of all that has gone before. We have listed eight personal characteristics common to our successful people plus motivation.



However, ultimately the successful man must stand apart. Every successful man has some eccentricity, some quirk, some off-beat characteristic which is indisputably his and which distinguishes him from all his fellows. For lack of a better word, we call this "color." Without it success, whatever your definition, is unattainable.

Job success and personal characteristics are related. Proof can be given that successful people possess characteristics to some degree and in varying combinations while less successful people are lacking in those same characteristics. Involved in all this, of course, is the criterion of success.

Success almost defies definition except as a matter of opinion. Opinions vary. The individual considered successful by his superiors may not consider himself successful. The reverse is equally true.

The most immediately useful index of success in the industrial situation is the opinion of superiors of

subordinates. That was the criterion of success on which our search for personal characteristics was based.

We found eight characteristics associated with job success to a greater degree than might be expected by chance. In dealing with our people we have developed a rationale to explain why they seem important.

In our specific situation we found that our successful people are highly intelligent, have a practical mechanical bent, enjoy reading and writing, are not the professional social worker type, are straightforward and frank, have predictable responses to most situations, are emotionally steady, and are content with their ability to handle situations. We do not assume that this list is exhaustive. Nor do we assume these characteristics hold true for all people in all situations. They are significant among our managerial and professional group and effectively distinguish our most successful men from the others.

We also know that overlying these personal characteristics is the immeasurable factor of motivation. Without motivation, no man can achieve success.

Finally, we firmly believe there is another intangible required: A man must have "color", be distinctive, be a man apart. Some characteristics we expect him to have in common with other successful men, but we expect that he will be an uncommon man; by his idiosyncracies he will be known.

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Evaluation Programs

(How Do I Know How I Am Doing?)

Dr. George L. Royer, F.A.I.C.

Administrative Assistant to the General Manager, Research Division, American Cyanamid Company, 30 Rockefeller Plaza, New York 20, N.Y.

(Presented before the 34th Annual Meeting of The American Institute of Chemists, Akron, Ohio, May 23, 1957.)

I. Background and Structure of Professional Development

Postwar Growth of Research

ANY review of the postwar decade would surely highlight the great expansion of research as one of the most significant developments of this period. Research today is not only a "Big Business" in a budgetary sense —it is "Big Business" in terms of the complex administrative problems involved.

This paper is to discuss evaluation programs, and its inclusion on the agenda is one example of the considerable thought being given to research personnel.

In discussing "evaluation" or "development", it is necessary to examine first, not only the techniques by which individuals are evaluated, but also the entire background or "value system" against which the evaluation program is shaped.

Problems In Research Management

American Cyanamid consistently has made a heavy investment in its research programs, and several years ago it was decided to establish a separate Research Division. This decision in turn prompted a number of shifts in the Research organization structure and personnel assignments. As a natural outgrowth of this, the Company took a close look at the nature of the new research role, and some of the personnel problems connected with it.

What were these problems? Most of them were quite clearly linked to the fact that in the past most research organizations have largely patterned their organizations after an industrial management or production structure. The normal characteristics of these administrative structures involve:

a. Job descriptions, in which all jobs are described and classified in detail.

b. Job rating, in which each job is "rated" and the wage structure is tied to this rating.

c. The wage structure is elongated to encompass all jobs and usually has narrow limits for each range within the wage structure.

d. Advancement or growth in title and salary is achieved by moving from job to job.

The above is, of course, a simplification of an extremely complex system, but in the main, it can be said that under this system the job hierarchy dominates the structure, and the men in it must move from job to job within this hierarchy to achieve real progress.

Another characteristic of this type of administrative structure is that it has a pyramidal outline with a narrow base. The number of top job classifications grows progressively smaller as the top of the hierarchy is reached. This has meant that in general not more than 10% of the persons in a given organization could expect to achieve certain salary levels, and *these were limited to the management group.*

The Nature of Research Work

Jobs in manufacturing may lend themselves to such an approach but this is not as true in research, where many jobs exist because the men make the jobs. It is evident as this problem is studied that the old concept of organization and salary structure based on jobs alone is not applicable to research personnel, where growth should be based on the ability of the man, not the job.

Mr. S. C. Moody, American Cyanamid's Vice President for Personnel, made an extremely clear statement of the new concept when he said: "We must recognize the distinct nature of the professional employee and find how to integrate his work into the organization more effectively. Next, we must see that he receives the kind of rewards in dignity, appreciation and compensation that will give him a satisfying and creative career in his field of competence. *We must recognize that a man can make fully as great a contribution in the role of a professional specialist as he can in the role of manager.* It would be disastrous if our employees were to receive the impression that the only way to a satisfying career, with high rewards, is through the ranks of management. We must build upon the rock of outstanding competence in all specialties. There must be twofold opportunities for advancement — into managerial jobs and into professional jobs."

Mr. Moody has made clear both the importance of the professional specialist to the company and the need for a program which provides him with opportunities and rewards comparable to those in management.

The question then arose, What kind of a program can we design that will retain, develop and reward a creative scientist in his field of competence and not force him into managerial ranks as the only means of attaining these rewards? This problem is an acute one, both from the point of view of morale, and the success of the research effort.

Scientists or Managers?

If administrative progression is the only way of advancement, then we may both lose a good creative

scientist and obtain a poor manager. Of course, many scientists can and should become managers, but what about those who have neither the desire nor the ability to do so?

Obviously, one way to meet this problem is to remove or change those conditions which forced many scientists to become administrators in order to get more money and recognition. But we know from surveys that more money alone is not the answer. The true professional is interested in the nature, scope, and structure of his assignment, his relationships with his colleagues, both in and outside of his own company. He wants and deserves the opportunity to contribute to journals, participate in conferences, expand his horizons and his competence. He also wants to know where he is going—and this means, in turn, he wants also to know where he *can* go—and how his supervisors view his present performance and competence.

In attempting to outline a logical program for professional growth at Cyanamid, we began by setting up certain minimum requirements or standards for competence. Within these broad standards are various levels of performance, knowledge, experience, and potential through which the scientist will pass at various stages of his career.

Professional Growth

These levels of competence are in turn related to salary. It is possible for a man to move up from level to level without changing his job. He is not limited or hemmed in by a series of compartmentalized job descriptions. He can grow, as it were, "like a tree"—with his roots spreading deeper into his chosen area of professional interest. These new levels of professional accomplishment, measured against the existing levels of managerial accomplishment, form the basis of Cyanamid's professional development program. Here, the *man* is evaluated, not the *job*. Growth possibilities depend on the ability of the man, not the confines of a job.

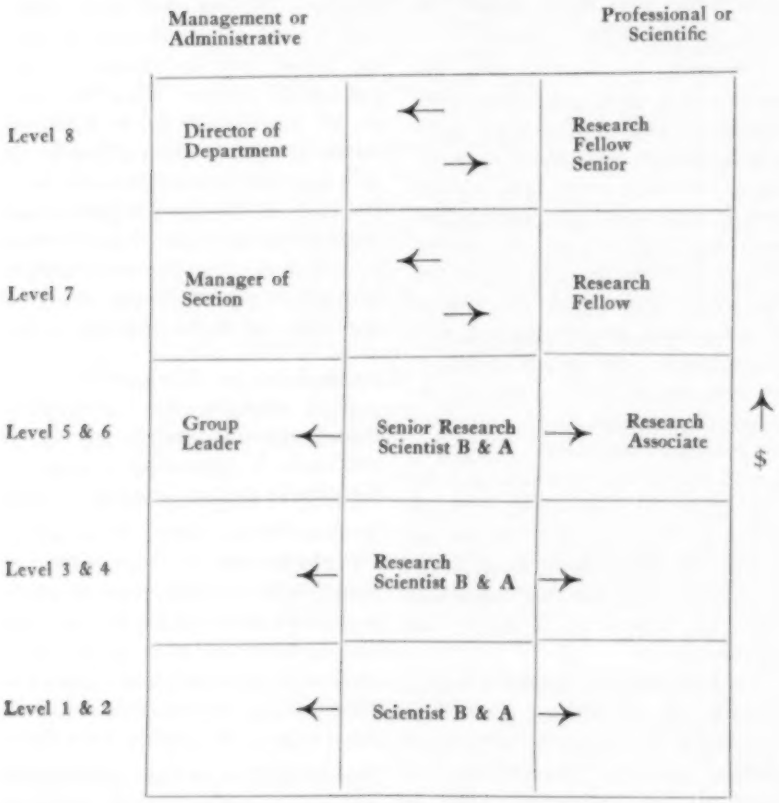
Guide Lines for Management

It is apparent that management cannot function logically merely on the basis of comparing a series of individuals without some guide lines. Realistically speaking, compensation — whether at the professional or hourly level—is based on certain general characteristics. No management has yet been able to come up with a method of administration which can function in a vacuum, independent of what is generally paid by other firms. Accordingly, as in most management practice, the top level of each research salary range is determined by surveys in cooperation with similar research organizations. Once the broad salary ranges have been established, it is possible to fit in the various levels of competence required in research work. Here again, despite numerous experiments, psychologists and testing experts have never been

FIGURE 1

American Cyanamid Company

RESEARCH DIVISION DEVELOPMENT PROGRAM



able to come up with a screening method which can evaluate the ability of professional personnel independent of the two major factors of education and experience. For this reason, the compensation for new research personnel coming directly from the university is based on their level of education.

Levels of Professional Attainment

Figure 1 shows the progression of development in Cyanamid's Research Division. The B.S. graduate enters at level 1 as a Scientist (i.e., Chemist, Physicist, Biologist, Chemical Engineer, etc.). After a minimum of one year's experience, it is possible for the outstanding man to reach level 2.

This level has qualifications similar to that for the M.S. degree, and the M.S. from college enters at this level. After a minimum of five years' experience from graduation the outstanding man can reach level 3, and at such time he is advanced to Research Scientist.

The Ph.D. enters into the organization near the top of level 3. The outstanding Ph.D. moves into level 4 after one year of experience. A minimum of five years after receiving his Ph.D. he may move into level 5 and advance to Senior Research Scientist. The outstanding B.S. or M.S. in science or engineering can progress through the same levels. For those who wish to develop further professionally there are the higher levels of Research Associate, Research Fellow and Senior Research Fellow.

On the management side the Group Leader is the first position, and these are chosen from levels 4 and 5, depending upon the responsibilities of the position. The advancing positions in this program are Manager of a Section and Director of a Department. It is possible to move from the professional side to the management side and vice versa. It is no longer necessary for research scientists to become managers to enjoy status or income.

A word here about the concept of experience in professional work. One year older does not necessarily mean one year of experience or development has been gained. It should be clear that five years in a repetitive job might mean one year of similar experience repeated five times rather than five years of new and broadening experience.

The scientist who grows professionally may advance through the professional development program until he reaches the level equivalent to his maximum knowledge, experience and potential. He will have to content himself with this growth level unless he is able to get more knowledge or experience. Sometimes the work done by a man may not utilize his full abilities. If he has the potential, it may be advisable for him to study more or transfer to a more challenging assignment.

It is research management's responsibility to utilize all personnel at their highest potential and make sure that the work being done stimulates rather than impedes, a man's creativity and progress. Proper placement is our goal and, although it is not easy to achieve, we recognize this and work toward it at all times.

II. Evaluation - Counselling — Performance Review

In attempting to fulfill its responsibility of utilizing personnel at their highest potential, our research management has developed a combined evaluation and counseling program. This involves the use of a Counseling Guide and a Performance Review form, in conjunction with two employee interviews.

The objectives of this method of review of an employee's performance are two fold:

1. *For Management*: To provide the immediate supervisor and higher levels of management with a means of evaluating the performance and potential of each employee and of summarizing this information in reports.

2. *For the Employee*: To enable him to review his own performance objectively, both alone and with his supervisors; to learn how he is doing and where he is going, and to insure that he has the fullest opportunity for maximum improvement and development.

The Counseling program involves five general steps to complete the review of an employee's performance through forms and interviews. They are:

1. Distribution and explanation of forms to employee.

2. Completion of the forms, insofar as possible, by both the employee and his supervisor, independently, prior to the counseling interview.

3. The counseling and performance review interview between the employee and his supervisor.

4. Discussion of the completed forms by the supervisor and the next level of supervision.

5. An interview between the employee and his second-level supervisor to discuss results of the evaluation and the interview with the employee's immediate supervisor.

Why do we suggest distribution of these forms to the employees as a first step? Primarily because we know that people tend to dislike and distrust what they do not understand. By giving them an opportunity to look over the forms at their leisure—and by suggesting that they make an attempt at a self-analysis, we believe some normal psychological resistance may be removed.

The two forms are the Counseling Guide, figure 2, and the Performance Review, figure 3.

Counseling Guide

The Counseling Guide is designed as a guide for a confidential interview between the supervisor and the employee. In considering the employee, the supervisor selects those factors which are unsatisfactory and need improvement and those which represent the employee's strong points. By suitable notations (such as plus or minus) he indicates on the form the comments which are to be made during the interview.

You will notice we do not attempt to rate specifically the level of performance on a particular factor. This helps to eliminate from the interview controversy about the exact level of performance. Thus, it is possible to concentrate on what can be done to improve an employee's weak points, and to emphasize most effectively his strong points.

No interview can be expected to cover all the items listed on the

Counseling Guide. The supervisor need not cover those factors where he feels the employee's performance is up to expectations.

FIGURE 2
Counseling Guide

I. QUALITY OF WORK
- Planning of work
- Experimental skill
- Thoroughness of work
- Interpretation of results
- Reliability of results
- Comments

II. PRODUCTIVITY
- Output of purposeful work
- Industriousness
- Effectiveness in completing plans
- Effectiveness in handling simultaneous assignments
- Comments

III. EFFECTIVENESS IN COMMUNICATION

Consider formal oral reports, informal exchange of ideas and information, written communications and record keeping.
- Organization
- Logic
- Factualness and completeness
- Effective use of language (conciseness, style, grammar)
- Ability to summarize
- Diligence in reporting
- Comments

IV. CREATIVITY
- Quantity of ideas
- Quality of ideas
- Scope of ideas
- Practical adaptation of ideas
- Recognition of the unusual
- Resourcefulness in planning experiments
- Comments

V. JUDGMENT

Soundness of conclusions and recommendations
- Objectivity (self-critical, unprejudiced)
- Recognition of significant information
- Cost consciousness
- Regard for safety
- Comments

VI. LEADERSHIP

Ability to secure cooperation and stimulate effective work
- Command of respect and confidence
- Acceptance and delegation of responsibility
- Planning and coordinating work of others
- Fairness
- Development of potential abilities in subordinates
- Comments

VII. JOB ATTITUDE
- Enthusiasm
- Interest in group and Company programs
- Constructive attitude toward Company policies
- Willingness to accept changes in assignment
- Willingness to accept undesirable tasks when necessary

Comments

VIII. PERSONAL CHARACTERISTICS
- Cooperativeness and ability to get along with people
- Tactfulness
- Respect and consideration for others
- Willingness to accept suggestions and criticisms
- Ability to make constructive criticisms
- Dependability
- Initiative
- Perserverance
- Maturity and emotional stability
- Neatness and personal habits
- Comments

IX. PROFESSIONAL STATUS AND PROGRESS

Knowledge of current developments in his field of specialization
- Breadth and depth of general scientific knowledge
- Scientific curiosity
- Activity or interest in his professional societies
- Activities in publications, both inside and outside the Company
- Comments

X. OTHER FACTORS

FIGURE 3

American Cyanamid Company
Research Division

Performance Review

Name_____ Date_____

Location_____ Department_____

Section_____ Group_____

Professional Classification _____

Prepared By_____ Reviewed By_____

Shown to and Discussed with the Employee on_____
(Date)

_____
(Supervisors Signature)

PERFORMANCE SUMMARY AND DEVELOPMENT PLANS

1. What are his major strong points? How can they be utilized most effectively?
2. What are the areas in which improvement is possible? How can this be accomplished?
3. Note any significant changes in his performance since the last review. What factors are responsible for the changes?
4. What is his present performance?
   Outstanding - Excellent - Good - Average - Fair - Poor
5. What is his capacity for advancement?
   A. Professionally?
   B. Administratively?
6. Comment on the opportunity for advancement in his present job.
7. Comment on the desirability of a change in assignment.
8. Comment on the employee's wishes regarding his future development.
9. Employee's comments.

The supervisor fills out this guide *before* the interview. This assists him in his discussion with the employee and in summarizing his information on the employee for inclusion in the Performance Summary form.

The Guide is not retained as a permanent record. On the contrary, it is recommended that the supervisor destroy the Guide in the employee's presence at the end of the interview.

Performance Review

The Performance Review form has been designed primarily for management as an evaluation summary, but also serves to show the individual employee where he stands.

Answers to the questions on this form should be concise, yet no significant information should be omitted. Some comment should be made on all items listed.

Question 4 is designed to provide a summary of an employee's over-all performance; this rating is to be based on a consideration of the items listed in the Counseling Guide. A rating of "Average", denoting a "generally satisfactory" employee, should be given when the over-all performance meets normal expectation.

Questions 8 and 9 cannot ordinarily be answered until after the interview.

This form should also be completed prior to the interview and reviewed by the next higher supervisor. In some cases it may be desirable to discuss the employee's performance with a third supervisor who is acquainted with the employee's performance. The employee should be told which persons (other than the immediate supervisor) have been consulted in completing the performance summary form.

The Counseling Interview is probably the most difficult step in the over-all Counseling Program because the supervisor and employee meet face to face to discuss personal opinions. The supervisor should conduct the interview skillfully and with great tact so that criticism will remain factual and constructive rather than subjective and emotional. The two persons should meet in an atmosphere of mutual respect and with the same objective of further developing professional or administrative ability.

III. The Personnel Inventory—Corporate Aids to Development

The work done with regard to personnel development and performance reviews on an individual basis is also indirectly involved with a top management tool—the Personnel Inventory. The objective of the Personnel Inventory is to give top management in large corporations a method of examining and analyzing certain aspects of its executive or technical personnel.

Most of the data in such an inventory study involves factual analyses of the types of ages, experience, and movements of salaried personnel

within an organization. Here, for example, is an outline of some of the data included in a recent report on our own Research Division, prepared by responsible Divisional Personnel and our corporate Personnel Relations Department.

Part I Factual Analysis of Personnel by Groups.

How many personnel? What are their jobs? What is their education? How much do we pay them? How old are they? How long have they been with us? How long have they been on present job, etc.

Part II Cross-Fertilization.

A. Transfers within Division—between locations.

B. Transfers "out" to other divisions.

C. Transfers "in" from other divisions.

D. Terminations — Past Five Years.

Such reviews are presented to the General Staff which consists of the President and seven Vice Presidents by a series of charts covering:

1. Total Personnel by Division
2. Educational Attainment
3. Number at Each Salary Level —by Degree
4. Number at Each Salary Level —by Service
5. Number at Each Salary Level —by Age
6. Utilization of Women in Division
7. Transfers between Locations of Division
8. Transfers from Division to other Divisions
9. Transfers into Division from other Divisions
10. Summary of Terminations — Five Years
11. Length of Service at Termination Date
12. Age of Termination Date
13. Degrees Held by Terminated Employees
14. Potential of Terminated Employees
15. Normal Promotion Pattern—Managerial Jobs
16. Supervisory & Managerial Positions—Potential of Incumbents
17. Candidates for Transfer into Supervisory & Managerial Work
18. Potential for Advancement in Scientific & Development Work

A final portion of this divisional Personnel Inventory or review also includes some individual summaries of the opinions of three or more supervisors about their subordinates. The emphasis in these reviews, however, is in getting a picture as a whole rather than for the counseling of the individuals. It is a snapshot of the organization for top management and involves a rough screening review of management strength rather than personnel reviews in depth.

While the chief objective of the Personnel Inventory is to help top management in its future planning, this work also has definite relationship to the operational phases of personnel development. The entire field

of management or technical development is still relatively new, but we do know that job placement is certainly one of the most effective means of development.

The Personnel Inventory reviews of the company have had definite impact on the movement of people. One of the functions of such studies is to highspot units or departments which may have become "dead end streets" offering limited opportunities for advancement or development. Other areas may show up as "road blocks" —where older, long-service personnel are impeding the progress of younger people down the line. In numerous cases where such cases have been detected, series of planned transfers of certain personnel have proved very effective in providing them with growth opportunities. A major tool for professional growth is company financed educational assistance. . . . whether it be in the management or scientific field. At Cyanamid such assistance may vary from bringing in outside consultants to providing leaves of absence for university study.

Personnel Experience Record

Another management tool used in an increasing number of companies to facilitate transfers and placements is the "Personnel Experience Record". American Cyanamid's corporate Personnel Relations Department maintains complete Personnel Experience Record files on several thousand executives, adminstrators and technical employees. These records are in turn tied in to an IBM Punch Card system which facilitates the finding of personnel within the company with the experience, education and other requisites for numerous openings. If, for example, the central group is asked by management to locate a "Process Engineer, single, age 30-40, with 10 years of plant experience, knowledge of the food processing industry, able to speak French, and willing to travel abroad", the IBM system will within minutes produce the cards of the people within Cyanamid who have such qualifications.

Personnel Development

Naturally, when managers and supervisors review a man's performance in an attempt to answer the query "How am I doing?" the next logical question is—"How can this man's work be improved?" In the old days, it was assumed that knowledge x skills = productivity or creativity. Today management has learned this equation is fallacious, unless the formula includes the work "attitudes" . . . attitudes held towards the man's job, his associates and the company. As management delves deeper into the art and science of the management of professional personnel, it is finding that scientists are, human beings, very much like all other employees.

Now, what influences attitudes? This would require at least two volumes to answer adequately — Freud, Jung, Adler and others have

all had their say. In the area where management can exercise real influence, it is now felt that management itself, through its policies, practices and relationships at all levels, is the determinant.

This means, in turn, that managers, whether they be presidents, department directors, or group leaders must know more and more about people and their attitudes. It is generally believed that almost every manager feels sure that he *does* know what his people are thinking—and yet, well-conducted attitude surveys have usually provided ample proof that there are gaps in the communication system.

Another area of modern management inquiry is the impact of the individual on the group, and vice versa. What is the best group structure? Which men can work better alone? What are the facts in group dynamics in professional work? How can our managers at all levels, be made cognizant of the importance of such factors? How can they themselves gain the attitudes, knowledges, and skills needed to make them able supervisors? Many of these questions and some of their answers are being sought in the design of training programs for professional managers at all levels.

IV Conclusion

These, then, are some of the major components of the work American Cyanamid is currently undertaking in these areas. It should be pointed out that in every case this work is regarded as a series of *evolutionary processes,* and not in any respect a final *static program.* We have a good many reservations and a certain amount of cautious respect for any work involving appraisals or judgments of people. It is felt, for example, that individual counseling and performance reviews, unless handled in extremely constructive and thoughtful fashion, can produce more harm than good. While there are many questions, it is felt that much progress has been made towards understanding people and enabling them to make their maximum contribution to scientific research, to the growth of themselves, and to the company.

Evaluation programs are no better than the leadership ability of the line organization which executes them. This leadership ability must be developed by training and experience in a management atmosphere where policies are established and clearly communicated from the top to the bottom.

This paper has attempted to describe our best efforts to date in designing a professional development program which provides "two-fold opportunities for advancement . . . into managerial jobs and into professional jobs".

Acknowledgment

As author of this paper I feel like Tom Sawyer since many people of our organization have helped me paint the fence. Since the organiza-

tion of the Research Division several years ago under the direction of Mr. K. H. Klipstein as general manager, many committees from our three locations at Bound Brook, Pearl River and Stamford have worked on our various research personnel policies. The newly organized Cyanamid personnel Relations Department, headed by Mr. M. Owen and under Mr. S. C. Moody, staff vice president for personnel, has also made many advances in company personnel policy. . . . I would like to express my appreciation to all those, too many to mention, who have made this paper possible.

New Association: The Chemical Sales Association of Pittsburgh, formed to promote interest in chemical selling. G. J. Esselen III of Pittsburgh Coke & Chemical Co. is its first president.

Appointed: E. McKendree Hayden, F.A.I.C., as special assistant to William H. Baldwin, president of The Stanley Chemical Co., subsidiary of The Stanley Works, East Berlin, Conn. He remains a vice president and director of the concern.

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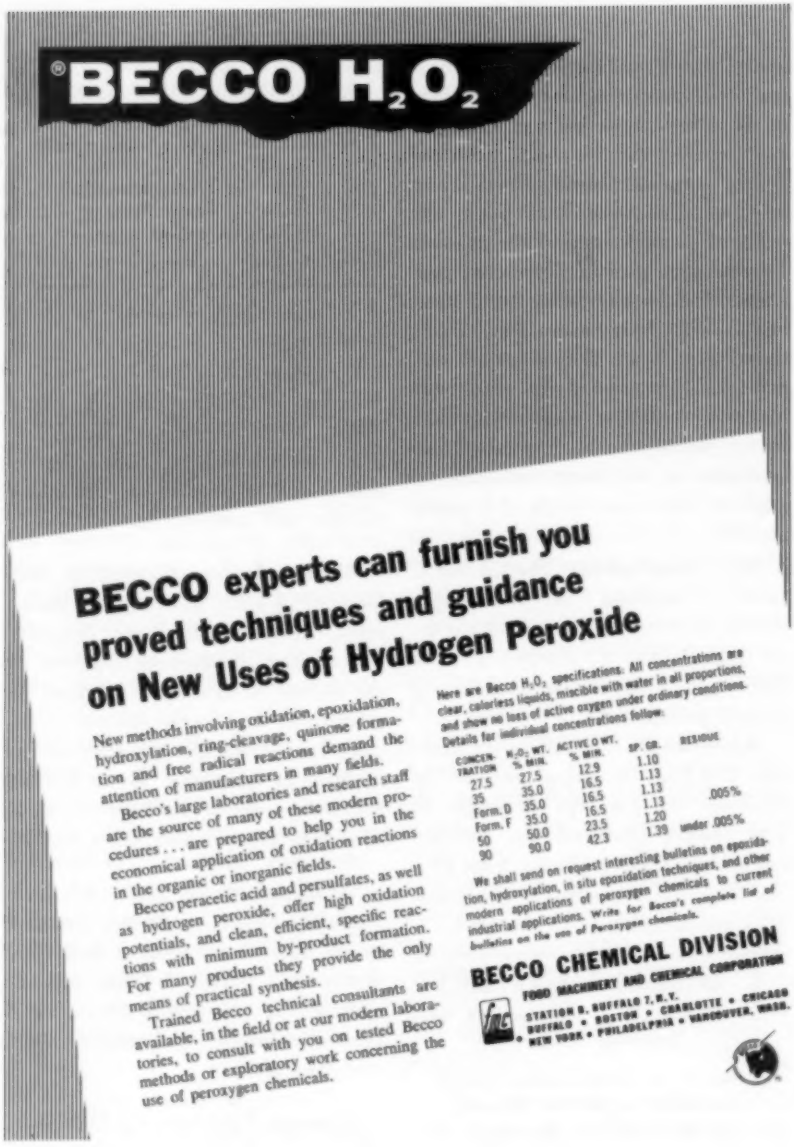
Faculty Fellowships: Available from Division of Scientific Personnel and Education, National Science Foundation, Washington 25, D.C.; offered as part of a program to improve the teaching of science, mathematics and engineering in American colleges and universities.

Honored: Dr. Winfred O. Milligan, F.A.I.C., professor of chemistry, The Rice Institute, Houston, Texas, and director of research of the Robert A. Welch Foundation, received the Southwest Award of the American Chemical Society, at its meeting in Memphis. He was cited for his pioneer work on x-ray, electron and neutron diffraction studies.

Announced: By Harry M. Zimmerman, F.A.I.C., general manager of the Plastics Division of Seiberling Rubber Co., Akron 9, Ohio, that the company is now marketing a vinyl plastic window, shatterproof and non-flammable.

Present Position: Of Delbert F. Jurgensen, F.A.I.C., is vice president, Development & Research, Blaw-Knox Co., Pittsburgh 22, Pa.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RESIDUE
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35 35.0 16.5 1.13
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Self-Appraisal—A Personal Annual Report

Robert F. Moore

Vice President, Richardson, Bellows, Henry & Company, Management Consultants, 1 West 57th St., New York 19, N.Y.

(Presented before the Thirty-fourth Annual Meeting, The American Institute of Chemists, May 23, 1957, at Akron, Ohio.)

EVERY man seeking to improve himself and his job should prepare a personal annual report. As he looks at and records accomplishments for the year he will ask himself about present progress and future prospects. He will take inventory of his strong points and shortcomings. His personal annual report will become his guide to effective personal growth for the year to come.

The practice of self-appraisal becomes more important because the managements of many companies are increasingly employing performance reporting to keep them informed about the quality and quantity of work of the individual. Sometimes this procedure results in a label being placed upon a man — "Blue" for promotion, "Yellow" for 'stay put' or "Red" for unsatisfactory. In the face of this growing trend of management to analyze and inventory manpower resources, all of which is a good idea, what should or what can you do in behalf of your own career to make sure you are given a fair performance review?

How can you undertake a "do it yourself" performance review? This is where the personal annual report idea can be useful as a practical and realistic approach to taking a good hard look at ourselves.

When you know what you have accomplished, and have qualitative and quantitative facts before you, and if you have a good understanding of where you can improve, you need have no qualms about a performance review. In fact you should welcome it, if it is one where the boss sits down with you to talk over your progress.

Personally, I believe that the most important time you can spend in the very near future are two hours in quiet, secluded, uninterrupted contemplation about yourself. This is a time for honest and brutal frankness.

Too many people delay this self-appraisal until something happens that forces them to it. To prevent someone else being brutal with you, do it yourself! Because change is inevitable, everyone sooner or later must examine himself. This becomes more urgent when the other individual gets the promotion, or if one is passed by for a raise, or if mergers or cost reduction programs dislocate our jobs. So to be prepared for the changes and chances of life, let us keep knowledgeable about ourselves. As a guide to self-analysis, I have

prepared ten questions . . . These questions are based on procedures followed by my firm when we undertake an executive audit of a company staff or appraise an individual for employment.

1. How well qualified am I for this position?

For a realistic answer, you will need a job description. If one is not available or in existence you should then write down the details of your work, responsibilities, authority and accountability. This should be checked by your superior to make sure that you both know and understand what your job is. Also write down what you believe to be the personal, technical, and experience requirements of the position. To be more objective, think in terms of what you would look for in hiring your own replacement.

Write down on your performance report any qualification you think you lack for your position.

2. How effective is my performance?

You and I know when we are doing a good job. In answering this question think in terms of accomplishments. What work has been finished, what deadlines met, with what results, at what cost? What are some of the special contributions you have made this year to your work, your department, your company? This is where facts speak lounder than blurbs.

Write down those areas in which you can improve your performance.

3. How Are My Personal Relations?

At this point of self-analysis let us emphasize the ability to maintain effective and productive relations with all levels of people. It is more than maintaining happy, contented relations. For example, all of us have a boss and he has a job to do. Your relation to your boss, your attitude toward him, and the way you carry out your assignments affects his performance and your own. At this point a very important part of this question is: "Do I have the right boss, do I respect him and do I enjoy working with him?" Your boss is very important to your effective performance. There is only one answer if you have the wrong kind of boss—change him. How? That's up to you.

Before you take drastic action, however, be sure which one of you is at fault. Check your own relationships with your peers and your subordinates. Do you all work well together? If you are not getting cooperation and the required results, take a good introspective look at your own relations. Fortunately, human relations skills can be acquired if you know your limitations.

Now, write down points for improvement in personal relations.

4. What are My Work Characteristics?

Personal qualifications become important only when they are applied to your job. It is not only what you have but how you use it. When you examine your work characteristics you will be asking how effectively you use your skills and experience—Do you work hard? Can you handle pressure? Are you analytical, creative? Can you make decisions? Do you make good use of time? Do you use your full potential? Are you striving to improve?

This phase of self-analysis is most important. Work characteristics become habits. You can make a habit of success, or of mediocrity.

At this point write down on your self-analysis sheet what you believe to be your work characteristics. Note any deficiencies to be remedied.

5. Aspirations and Drive?

Under this question you ask yourself, "What is my goal, how high do I aspire, and are my aims realistic? Specifically, "What do I want to be doing five, ten, fifteen years from now?" Then the important part of this question, "Do I want to make the sacrifices and do I have the desire, the dedication and the drive to carry me through to my goals?" These are hard questions to face truthfully. How often have you seen a person aspire to a position, title and money, and after achieving them become extremely unhappy with the responsibility?

There is a growing concept among companies that recognizes the comparative value of individual contribution as being at least equally important as supervisory or managerial skills. In these companies the trend is to recognize the individual contribution by paying him the same as the manager.

Write down your aspirations and assess the power of your drive.

6. What are My Interests and Values?

Closely allied to the previous question is this careful listing of those activities which really interest you. Think in broadest terms about your work, your hobbies, or community activities. What do you value most in life? Practical matters, religious, aesthetic, human affairs?

This is the key question that helps you determine whether you are in the right work. If your interests and values are not consonant with your occupation your chances of satisfactory performance, further growth and real achievement are problematical.

This is your personal challenge to write down the truth about your interests and values.

7. How Is My Personal Adjustment?

Under this heading you may consider how well you handle pressure and personal problems, successes and

disappointments. Are there personal characteristics that need attention, modification or elimination? In brief, how mature are you to face, survive and conquer the vicissitudes and complexities of life?

Be sure to give this question careful thought and list your findings.

8. Intellectual Functioning?

We, as a firm, give adult intelligence examinations to executives not only to measure intelligence but to try to determine how well a man uses his intellectual equipment. Chemists and engineers like yourselves usually make high scores in the top five per cent of the population and at least comparable to the executive level.

High intelligence becomes useful only when it is properly applied and integrated with other qualities. Like a high powered engine, its value is in its productive application.

Your question here is "Am I doing the best I can with MY mental equipment?"

9. What is the Company Climate?

Previously we referred to the importance of the right boss. He is quite often the reflection of "company climate" meaning the atmosphere or the spirit of the organization. The importance of this question to your self-analysis is that your personal growth is definitely affected by the climate in which you work. Climate can mean many things—a company that you can be proud to work for, policies that allow opportunities for personal contribution, growth, promotion and rewards.

The company you keep or keeps you is crucial to your career. Can you describe your company climate?

10. How is My Progress?

This question summarizes the previous nine, for if you have answered them you have a good idea of where you stand. You will want to include practical questions about salary and promotions and potential for growth. How do you stack up with your fellow men? Is your progress according to your career time table—or is it ahead or behind time?

Write down the facts.

Potential and Plan of Action

Self-analysis becomes truly meaningful and resultful when you do something about the findings. The first step, of course, is to check your answers. Try them out on your best friend, your wife, or whoever you value as a counselor. If you want an objective outside view, see a reputable psychologist, but make sure he is a

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Now that you have an understanding of your potential it is up to you to take action by setting a plan and a program for yourself. Where do you need to improve and how will you go about it? Do you need more technical skill, more personal effectiveness, more scope for your talents? Whatever the areas for improvement, a plan of action and a time table will bring your goals closer to realization.

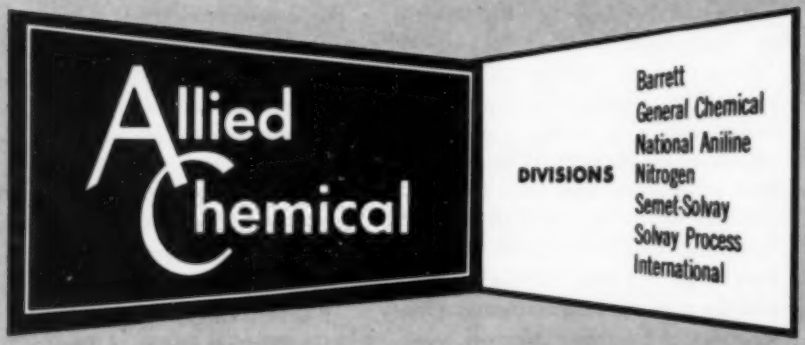
Your self-analysis — your personal annual report—has international implications. We have all heard a great deal about the scarcity of technical manpower and how Russia is outstripping the U.S. in this regard. Less than half of our technically trained graduates end up in technical engineering or scientific positions. This fact further reduces the national technical manpower pool. There is nothing especially wrong with natural evolution toward occupations that suit our talents and abilities and we should not let statistics about technical manpower scare us.

However, may I emphasize the importance to those of us who do stay in technical positions to make sure, along with the organization for whom we work, that we are given the fullest opportunity to use our whole potential and talent. This desirable objective can be furthered by a system of company performance reviews combined with our individual self-analysis annual report.

The proper pursuit of such a process spurred on by the initiative of you, the individual, will go a long way toward expanding the quality of our technical manpower utilization. We will then have no need to compete with mass production of so-called scientific personnel, which I suspect are turning out to be technicians rather than engineers and scientists.

Thus each of you has within yourself the personal power to contribute to the quality of the national technical manpower pool by making sure that you know and use your full potential and talent in the right field for *you*, in the right company for *you*, and the right position for *you*.

Self-analysis is worthwhile. It will help you prepare for those certain opportunities ahead.



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How Does the Chemist's Salary Compare?

Dr. Donald W. Collier

Vice President and Director of Research, Thomas A. Edison Industries, McGraw-Edison Company, West Orange, New Jersey.

(Presented at the 34th Annual Meeting of THE AMERICAN INSTITUTE OF CHEMISTS, May 23, 1957, Akron, Ohio.

A COMPREHENSIVE survey of chemists' and chemical engineers' salaries was published last year by the American Chemical Society.[1] It covered a total of over 64,000 chemists and chemical engineers in a wide variety of types of industries and positions. Thus this survey gives a fairly complete answer to the question, "Once in the profession, how does the salary compare among the various choices available to the chemist or chemical engineer?" I shall discuss how the salary of the typical chemist or chemical engineer (I define "typical" as the median salary for all types of positions and industries) compares with the typical member (defined in the same manner) of other professions, as can be determined from published data of similar nature to the ACS survey.

The salary surveys of all professions have not been made during the same year. With the steady increases in salaries that have occurred throughout, it is necessary to adjust all the survey results to a common year before meaningful comparisons can be made. The most recent salary survey is that of the Engineers Joint Council covering over 107,000 engineers' 1956 salaries.[2] Therefore, I have estimated normalizing factors for the surveys to bring them all to the year 1956.

In many cases, data taken over a number of years indicates the rate of salary growth in the profession and this has been used in extrapolating the data to 1956. A study of salary trends has shown that an average annual increase during the last six years was 4½%. This has been used where trend data were not available. A factor which should be considered is the amount of formal academic training required beyond high school, before one is qualified to enter the profession. This academic training might be looked upon as the investment one makes in a career, and the total earnings over one's career as the return on this investment.

Let us attempt to answer the questions, (1) Is the chemist keeping up with the trend of the expanding economy? (2) Is he doing as well as other professions in terms of the formal preparation required?

To answer the first question, let us examine the trend of chemists' salaries during 1950-56, since it represents a period of growing shortage of

1. *Chemical & Engineering News*, April 9, 1956, p. 1731.

2. Engineers Joint Council Report No. 102. Professional Income of Engineers 1956.

trained men and one in which fairly reliable data are available. [3,4] One complaint is that the professional man's salary is not keeping up with the cost-of-living index or with the increases that have been granted to typical union workers. If we take the median starting salary for B.S. chemists, this is not supported by Figure 1. In 1950, the cost-of-living index was 102.8. It is estimated that it will average 120 during 1957. To make the comparison more vivid, I converted the median B.S. chemist's starting salary and the average factory worker's earnings to an index with the same 102.8 value in 1950. The B.S. chemist is leading the parade, having increased 53% over the period 1950-56, whereas the factory worker's income has increased 36% and the cost of living, 13%.[5] In 1950, the B.S. chemist's starting salary was only $50 a year more than the average annual factory worker's income. In 1956, it was $640 or 15.4% higher.

Other representatives of the scientific profession, while starting from a higher base, have not increased their salaries by as high a percentage during this period, as shown by the Los Alamos surveys[6] of a variety of professional people. The salary of a B.S. with five years of experience has increased by 44%, and 37% at the 14-year level, whereas corresponding figures for Ph.D. salaries are 41%, and 35%, respectively.

These data indicate that the law of supply and demand is a more potent force than the union bargainer. During the period, there has been a tremendous expansion of technical activity, particularly in research and development, which tends to create a large demand for the less experienced worker. This, coupled with the shrinking sizes of science and engineering graduating classes, has resulted in the maximum ratio of demand to supply being at the newly graduated level.

In making salary comparisons, one frequently looks at the median or average of all salaries in various professions. Such a comparison is shown in Figure 2, [1,2,7,12] on the basis of estimated 1956 median salaries. Physicians are the highest paid, making almost twice as much as chemists and engineers, whose median salaries are essentially the same. Incidentally, the median salary for chemists is

3. *Chemical & Engineering News*, Sept. 3, 1956, p. 4266.
4. Private Communications.
5. Department of Labor Publications of "Employment and Earnings" and "Consumer Price Indexes."
6. Los Alamos Scientific Laboratory National Surveys of Professional Scientific Salaries 1955-56.
7. Medical Economics, Oct. 1956, p. 110. Copyrighted 1956, by *Medical Economics*, Oradell, N.J. Reprinted by permission.
8. American Dental Association, 1956 Survey of Dental Practices.
9. American Institute of Architects. "Progress Report." 1951.
10. U.S. Deparment of Commerce, Survey of Current Business, Dec. 1956, p. 26, "Income of Lawyers in the Postwar Period."
11. National Science Foundation, Scientific Manpower Bulletin No. 7, Nov. 1956.
12. Dept. of Labor, Bureau of Labor Statistics, Bulletin No. 1188-17.
13. U.S. Dept. of Commerce, Survey of Current Business, June 1956, p. 9. Income Distribution in the United States 1952-55.

TABLE I

Profession	Minimum Years of Academic Preparation "P"	1956 Estimated Career Earnings "E"	Incremental Earnings per Year of Academic Preparation E-$196,000 / P	Ref. No.	Yr. of Survey	Sample Size
B. S. Chemist	4	$326,000	$32,500	1	1955	10,783
Ph.D. Chemist	7	401,000	29,300	1	1955	12,549
B. S. Chemical Engineer	4	432,000	59,000	1	1955	6,194
Ph.D. Chemical Engineer	7	486,000	42,500	1	1955	1,218
All Other Engineers	4	380,000	46,000	2	1956	103,751
All Other Ph.D. Engineers	7	450,000	34,900	2	1956	1,707
Physicians, General Practice	7	505,000	44,100	7	1955	10,919
Physicians, Specialist	8½	635,000	51,600	7	1955	10,919
Dentists	6	495,000	49,800	8	1955	6,000
Lawyers—all	6	353,000	26,200	10	1954	10,894
Lawyers—major salaried	6	374,000	29,700	10	1954	3,660
AIA Architects—Individual	5	550,000	70,600	9	1949	3,000
AIA Architects—Privately Employed	5	372,000	35,200	9	1949	450
Construction Electricians	1	309,000	113,000	4	1956	
Maintenance Electricians	1	218,000	22,000	12	1956	1,545
Upper Quartile B. S. Chemists	4	495,000	124,000	1	1955	10,783
Upper Quartile Ph.D. Chemists	7	612,000	87,000	1	1955	12,549

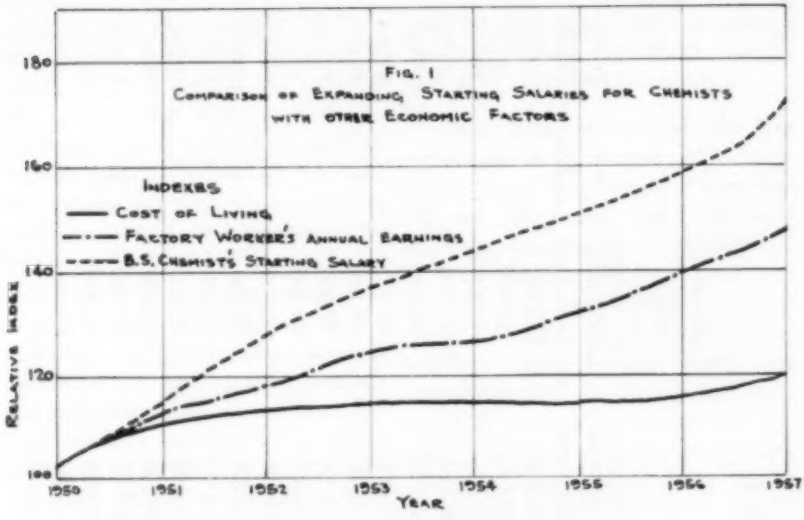
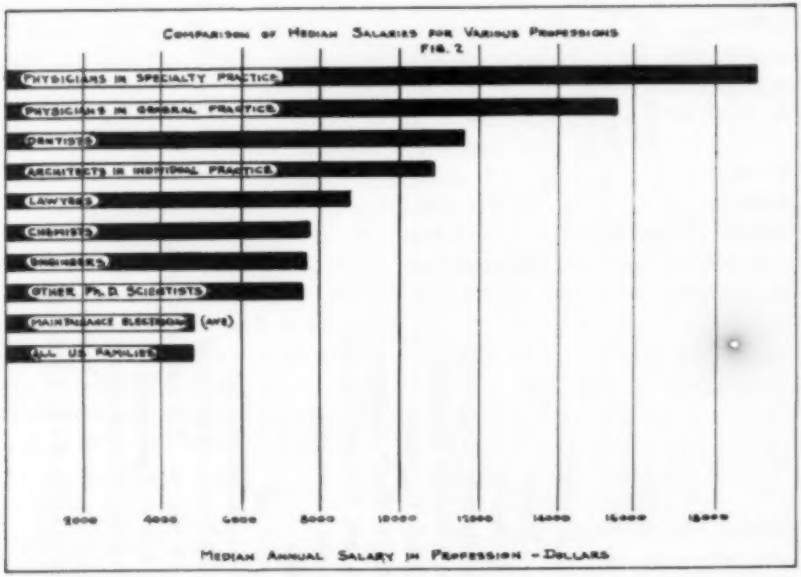


FIG. 1
COMPARISON OF EXPANDING STARTING SALARIES FOR CHEMISTS WITH OTHER ECONOMIC FACTORS
INDEXES
COST OF LIVING
FACTORY WORKER'S ANNUAL EARNINGS
B.S. CHEMIST'S STARTING SALARY
RELATIVE INDEX
180
160
140
120
100
1950
1951
1952
1953
1954
1955
1956
1957
YEAR


COMPARISON OF MEDIAN SALARIES FOR VARIOUS PROFESSIONS
FIG. 2
PHYSICIANS IN SPECIALTY PRACTICE
PHYSICIANS IN GENERAL PRACTICE
DENTISTS
ARCHITECTS IN INDIVIDUAL PRACTICE
LAWYERS
CHEMISTS
ENGINEERS
OTHER Ph. D. SCIENTISTS
MAINTENANCE ELECTRICIAN (AFL)
ALL US FAMILIES
2000
4000
6000
8000
10000
12000
14000
16000
18000
MEDIAN ANNUAL SALARY IN PROFESSION - DOLLARS

higher than that for 82% of all U.S. families. Such a comparison can be misleading, however. It takes no account of the varying distributions of ages and training among those whose salaries are being compared and therefore cannot be representative of a typical individual in the profession.

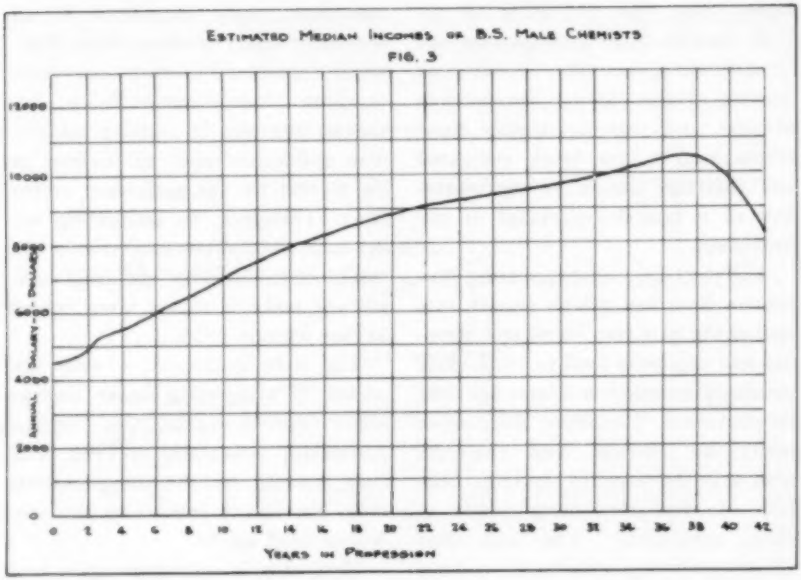
The chemical and engineering professions have had a high growth rate during the past few years, and chemists and engineers tend to reach their maximum earnings at a later age than do physicians. Therefore, the median salary for chemists and engineers tend to be depressed by the large fraction of relatively young people in these professions. The fact that chemists and engineers appear to have almost identical medians is also deceptive, because the sample yielding the median in the chemist's case consisted of about 40% Ph.D.'s, whereas the sample on which the engineer's salary is based contained only 1.7% Ph.D.'s. Therefore, simple median professional salaries are not a good basis on which to attempt to answer the question, "How does a typical individual's salary compare?'

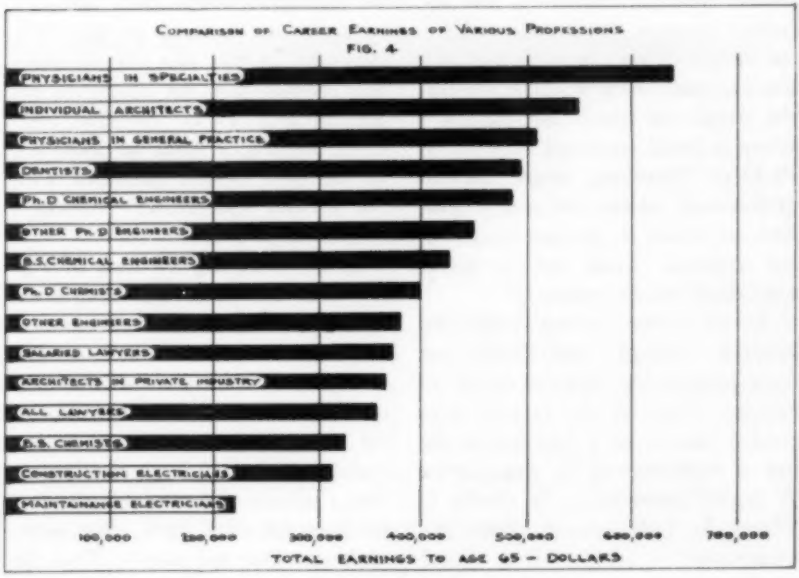
To get a proper salary comparison between "typical" individuals, one must consider the "growth curve" of salaries. Most of the surveys have yielded salaries as a function of the age or experience of the respondents. A typical presentation is shown in Figure 3. Such a curve shows the progression of salary that a typical individual might experience if all non-merit salary increases were eliminated (non-merit increases are those resulting from cost-of-living advances, increases in starting salaries, new union contracts, an increase in the market for the profession, or the like). Therefore, by integrating under such a curve, one can estimate the total career earnings one might expect to make if things were frozen as they were in 1956.

The data in Figure 4 were obtained by integrating under median salary growth curves for various professions normalized to 1956. The time covered by the integration is from the age of entry into the profession until age 65.

Physicians in specialties again lead the professions with career earnings, based on net income, of $635,000. However, in this case the engineers and chemists are not nearly so far behind, with Ph.D. chemical engineers, earning a total of $480,000 during their careers compared with the general practitioner physician's total eanings of $505,000.

Before accepting the data in Figure 4 at face value and making too many conclusions, one should understand some of the ameliorating factors behind them. The totals for the physicians, for instance, are based on net income after deduction of professional expenses, such as an automobile, a portion of the house if the doctor keeps his office there, office assistants, etc. (but not taxes). Thus the


ESTIMATED MEDIAN INCOMES OF B.S. MALE CHEMISTS
FIG. 3
ANNUAL SALARY IN DOLLARS
0
2000
4000
6000
8000
10000
12000
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42
YEARS IN PROFESSION


COMPARISON OF CAREER EARNINGS OF VARIOUS PROFESSIONS
FIG. 4
PHYSICIANS IN SPECIALTIES
INDIVIDUAL ARCHITECTS
PHYSICIANS IN GENERAL PRACTICE
DENTISTS
Ph. D CHEMICAL ENGINEERS
OTHER Ph. D ENGINEERS
B.S. CHEMICAL ENGINEERS
Ph. D CHEMISTS
OTHER ENGINEERS
SALARIED LAWYERS
ARCHITECTS IN PRIVATE INDUSTRY
ALL LAWYERS
B.S. CHEMISTS
CONSTRUCTION ELECTRICIANS
MAINTAINANCE ELECTRICIANS
100,000
200,000
300,000
400,000
500,000
600,000
700,000
TOTAL EARNINGS TO AGE 65 – DOLLARS

net income of a typical physician is about 64% of his gross income. Because of these deductions, the physician probably enjoys a standard of living higher than his net income would indicate.

On the other hand, the balance is not entirely in favor of the physician in business for himself. Physicians work long hours and, on an hourly basis, the 1956 median income of general practitioners is estimated at $5.34. This compares with construction electricians who make $3.35 an hour and with overtime can double that. The physician does not get paid for overtime.

Another factor, to be considered when making comparisons between chemists and chemical engineers who are mainly employed by industry, and physicians and other professionals such as architects and lawyers, is the so-called "fringe" benefits provided by industry. These include retirement pensions, paid vacations, sick leave, group insurance, etc. The average cost per employee in the chemical industry for such fringe benefits was $946 in 1955,[14] so perhaps this additional $40,000 of career benefits should be added when comparing industrially employed professionals and those working for themselves. Physicians tend to reach their maximum earnings in their early fifties, whereas industrially employed chemists and engineers tend to increase their earnings almost until retirement.

14. *Chemical Week*, Oct. 27, 1956, p. 30.

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However, the proportion of self-employed professionals who continue to work and earn sizeable incomes after 65 is probably higher than industrially employed professionals. When these factors are taken into balance, it is probable that the earnings picture is not so heavily in favor of self-employed physicians and architects as first appears from an examination of Figure 4.

Also to be noted is that Ph.D. chemical engineers appear to lead the parade of total career earnings for all professionals not essentially in private practice. B.Sc. chemical engineers appear to do slightly better than Ph.D. chemists; and B.Sc. chemists appear to be the lowest paid of the professionals. Perhaps the chemical engineers' earnings are higher than the chemists' because they tend to go into administration in higher proportions. Traditionally, management positions have paid higher than straight scientific positions, but there is a strong movement afoot in industry to put salaries for outstanding technical people on a par with management salaries. Perhaps a survey made

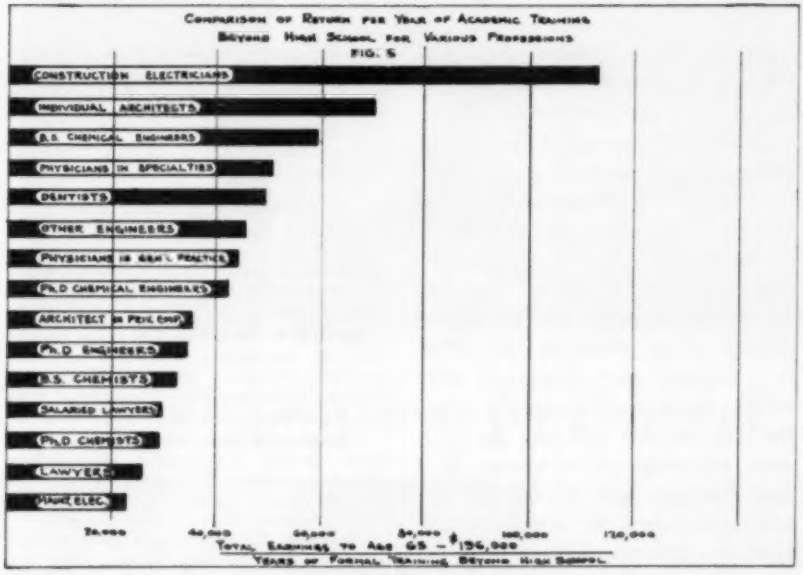
twenty years hence will not show these differences.

For comparison, I have included two typical craftsmen — electricians working in the construction industry, and maintenance electricians. For both of these crafts there is a 4-year apprenticeship including formal classroom instruction equivalent to about one-year of collegiate training. The earnings of an apprentice average about half that of a journeyman and the total career earnings, (Fig. 4), were arrived at by multiplying the average journeyman rate by 65-22, and half of this rate by 22-18. The construction electrician's total earnings is probably a fictitious number because it is based on working a 40-hour week of straight time, 52 weeks a year. Construction workers usually do not work steadily, but during peak seasons of activity frequently work overtime at 1½ and double pay. Since representative fractions of time not worked and worked at overtime rates are difficult to arrive at, I used the foregoing "nominal" earnings figures for construction electricians. Both craftsmen trail behind the professionals in total earnings, particularly the maintenance electricians who do work steadily and usually at regular time.

One further thought: The comparisons in Figure 4 are made for "typical" representatives of the various professions, i.e., based on the median salaries. That is not to say that there is no premium on excellence in your chosen profession. If we take B.S. chemists' and Ph.D. chemists' salaries at the upper quartile point (75% of the profession earn less than these salaries), the B.S. career earnings are $495,000, higher than the median Ph.D. chemical engineer, the top privately employed professional. A Ph.D.'s career earnings are $612,000 which rivals the top paid professional, the specialist physician.

Earlier, we proposed to evaluate salaries in terms of the return in income balanced against the additional formal academic training required to qualify for entry into the profession. To do this, I have taken the average factory worker's income as representative of what one might expect to earn with no additional training beyond high school. I have subtracted this income (multiplied by 65-18 years) from the total career incomes (Fig. 4). This incremental income was then divided by the minimum number of years of formal academic training beyond high school necessary to qualify for the profession (three-years college plus four-years medical school for general practitioners; four-years college plus three-years graduate school for Ph.D.'s; three-years college plus three-years law school for lawyers, etc.).

The results appear in Figure 5. The order is somewhat different than in Figure 4, with construction electricians leading the list, but with maintenance electricians still at the bottom. Architects in individual prac-



tice now seem to be the professionals who are getting the highest return per year of investment in academic training (5-years). However, the data are based on a salary survey made in 1950; thus they involve considerable extrapolation and might not be too reliable. The next is the B.S. chemical engineer, who apparently earns during his career $59,000 for each of the four years of formal academic training he invested beyond high school. In general, the professionals who require only four years to prepare appear to be having a higher rate of return on their preparation than do the Ph.D.'s whose extra incremental earnings are not enough to offset the 75% longer training period.

Again it should be noted that the upper quartile chemists discussed in relation to Figure 4 would have returns on their investment in education that would put them at the top of the list. Therefore, it would be unjustified to conclude from Fig. 5 that formal academic training does not pay off. Certainly from a job satisfaction standpoint, if one trains to the highest level of his inherent ability. he will undoubtedly reap the greatest total returns in career satisfaction. If these data caution against anything, it is against over-training beyond one's inherent capabilities, since a good B.S. chemist or chemical engineer who gets into the more commercial phases of his profession will generally outstrip in earnings the mediocre Ph.D. who stays in research.

We have now seen how the chemist's salary compares. The conclusion to be drawn is that the differ-

ences between professions are probably not as great as between individuals within a given profession. Therefore, the advice I would give to the young person deciding on a career is to select the profession that you like the most and train yourself to the highest efficiency your capabilities will permit for the type of career you would like to have. For the person already in the profession, my advice is to evaluate your strong and weak points, improve the weak and select the activities that will take the maximum advantage of the strong. It is here that you will do the best job and thereby reap the largest returns, both in economic income and job satisfaction.

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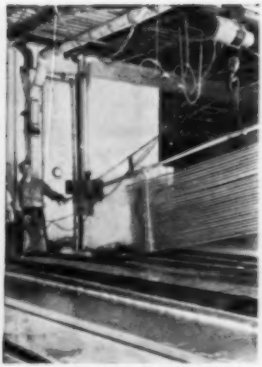

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New Position: For George Ciprios, A.A.I.C., who has joined the staff of the Process Research Division of Esso Research & Engineering Co., Linden, N.J. He received the Master's degree in chemical engineering from Columbia University in February.

Scheduled: An International Conference on Scientific Information, sponsored by the National Science Foundation, National Academy of Sciences, National Research Council and the American Documentation Institute, to be held in Washington, D.C., in November 1958.

Golden Anniversary: For American Cyanamid Company, New York 20, N.Y., which was organized in 1907, with a single plant for the production of calcium cyanamide. Today it operates more than 40 plants and laboratories, here and abroad in the production of a wide variety of chemicals.

Older Workers: Those over forty-five, "represent countless years of rich and seasoned experience, judgment and stability, and constitute an immensely valuable asset in the nation's work force," according to the NAM, who urges employers "to observe voluntary hiring practices which give consideration to skills and abilities rather than to any arbitrary age factor." By 1965, NAM predicts, "employees either under 24 or over 45 will comprise the majority of the expanded labor market."

Appointed: Frank E. Firth, F.A.I.C., as head of Marketing Research and Product Development, Elastomer Coatings Division, Rhee Elastic Thread Corp., Warren, R.I. He is co-author of *"Marine Products of Commerce."*

Retired: Dr. Edgar C. Britton, F.A.I.C., as director of the Edgar C. Britton Organic Research Laboratory of the Dow Chemical Co., Midland, Mich. He continues to serve as a research consultant on a company-wide basis. He also continues as a member of the company's Agricultural Chemicals executive committee and as a board member and secretary of Dow Corning Corporation.

Elected: Philip P. Gray, F.A.I.C., as a vice president of Wallerstein Co., Inc., New York 16, N.Y. Since 1934, he has been chief chemist.

Elected: Cecil M. Shilstone, F.A.I.C., of Shilstone Testing Laboratory, New Orleans, La., as vice president of the American Council of Independent Laboratories, Inc., Washington 14, D.C. Past president, Dr. Roger W. Truesdail, F.A.I.C., of Truesdail Laboratories, Inc., Los Angeles, Calif., was elected secretary. The Council's Committee on Legislation recently recommended a continuing strong fight against tax exempt and tax favored organizations, universities and non-profit science institutes which compete unfairly with independent laboratories in testing and applied research.

Starting Salaries: For Ph.D. graduates in engineering from Carnegie Institute of Technology, Pittsburgh 13, Pa., are $600 to $750 a month. The higher salaries usually go to those who have had some experience before continuing advanced studies.

Appointed: Milton C. Lauenstein, M.A.I.C., as head of the Chicago Sales District of the Silicone Products Department of General Electric Company of Waterford, N.Y.

Planned: By the Federation of Paint & Varnish Production Clubs of Philadelphia 7, Pa., a Paint Research Institute. Arrangements and a site for the institute will be recommended by the Federation's Long Range Planning Committee.

Program: To encourage scientific education is announced by the Manufacturing Chemists' Association, 1625 Eye St., N.W., Washington 6, D.C. To cost $1,000,000 for a five-year period, the program's objectives are to inspire qualified students to choose science; to assist educators through the development of science-teaching aids; to aid science teachers toward the goal of increasing their numbers, their effectiveness, and their prestige.

Comment on Catalytic Oxidation

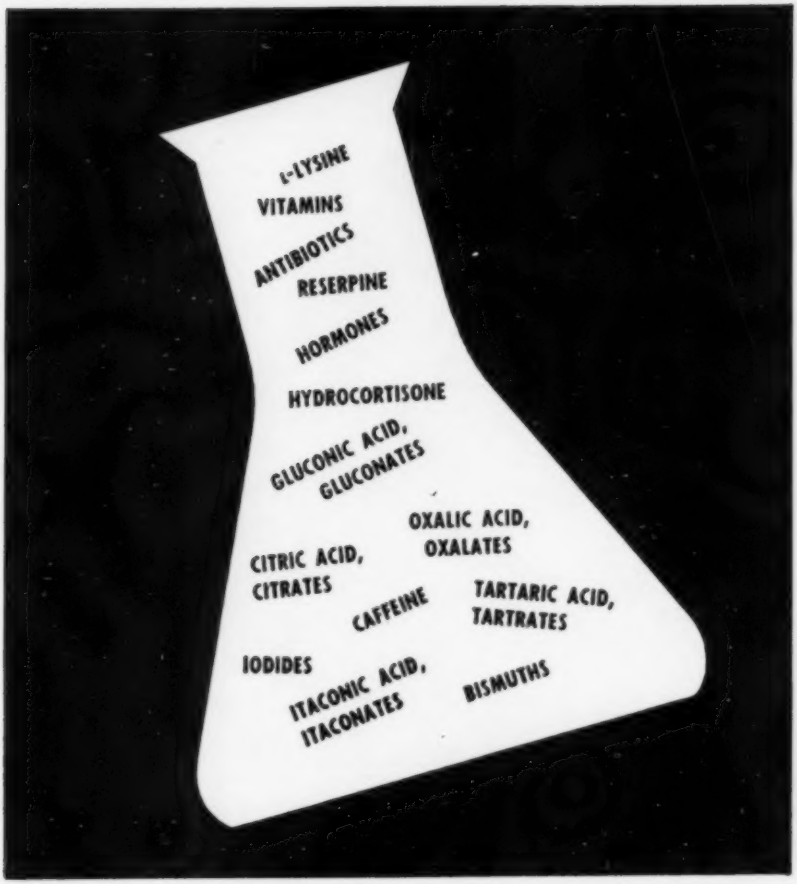
"Catalytic oxidation persisted so in my mind that at the beginning of 1948 I could no longer resist the urge to give most of my time to the catalytic oxidation of organic substances to water and carbon dioxide, for I felt certain that this line of research would eventually lead to discoveries of importance in industry and nature . . . Brilliant biochemists have made rapid progress in the field of catalysis. They liken a living cell to a factory wherein the enzymes are machines which transform starting materials into finished products, thereby inspiring our engineering mind . . . The most important phenomenon of life is enzyme oxidation. . . . We have found that during the life of oxidation catalysts a most important factor is the concentration of oxygen in the air-fuel mixture . . . There is a minimum and a maximum content of oxygen in the air necessary for the human machine to function . . . And here you have the up-to-date step of the evolution which has led me to the hypothesis that maintenance of the normal functioning of the human machine is possible by increasing the oxygen content in the air breathed in homes and working quarters as the body ages . . .

"Dr. Otto Warburg has provided the world with a discovery of extreme value — probably the greatest in cancer research—in pointing out that a cancer cell can obtain about as much energy from fermentation as from respiration, but a normal cell obtains more energy from respiration than from fermentation. There is the fundamental change in the enzyme reaction. There is the catalytic problem—and to solve it by regeneration and replacement should not take too long."

Eugene J. Houdry
(*Speaking before the First International Congress on Catalysis*)

Appointed: As a member of the Corporation of the Polytechnic Institute of Brooklyn, N.Y., Dr. John E. McKeen, Hon. AIC, president and chairman of Chas. Pfizer & Co., Inc., Brooklyn 6, N.Y.

Announced: By Bernard R. Krashin, M.A.I.C., president of Colton Chemical Co., Cleveland 14, Ohio, the appointment of H. W. Strong, Jr., as vice president in charge of operations.



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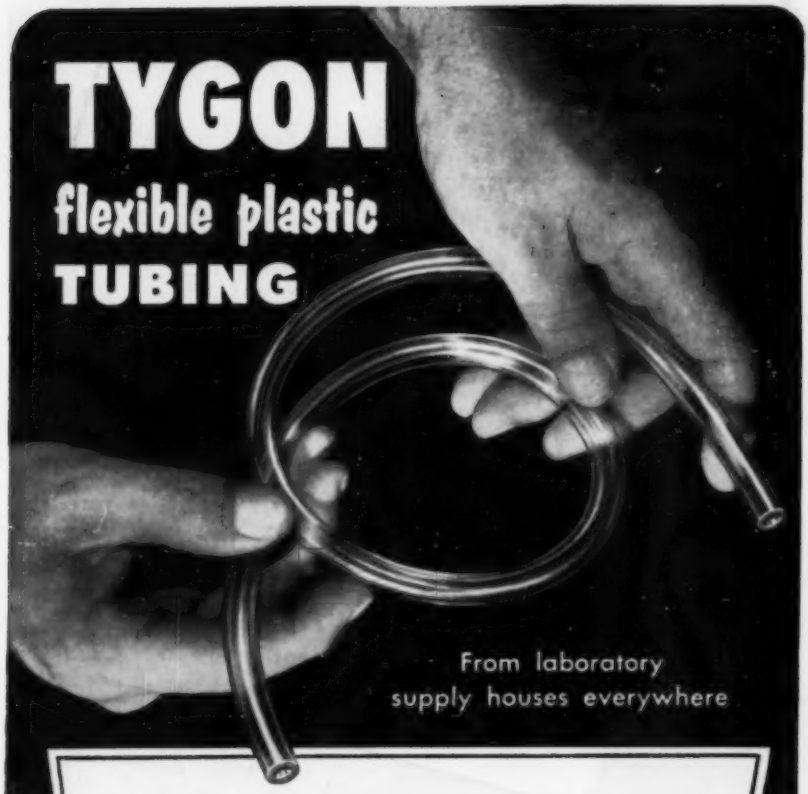

From laboratory
supply houses everywhere

✓ *Handles every laboratory application*

✓ *Glass-like transparency for visual control*

✓ *String-like flexibility for easy handling*

✓ *First choice of laboratories the world over*

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